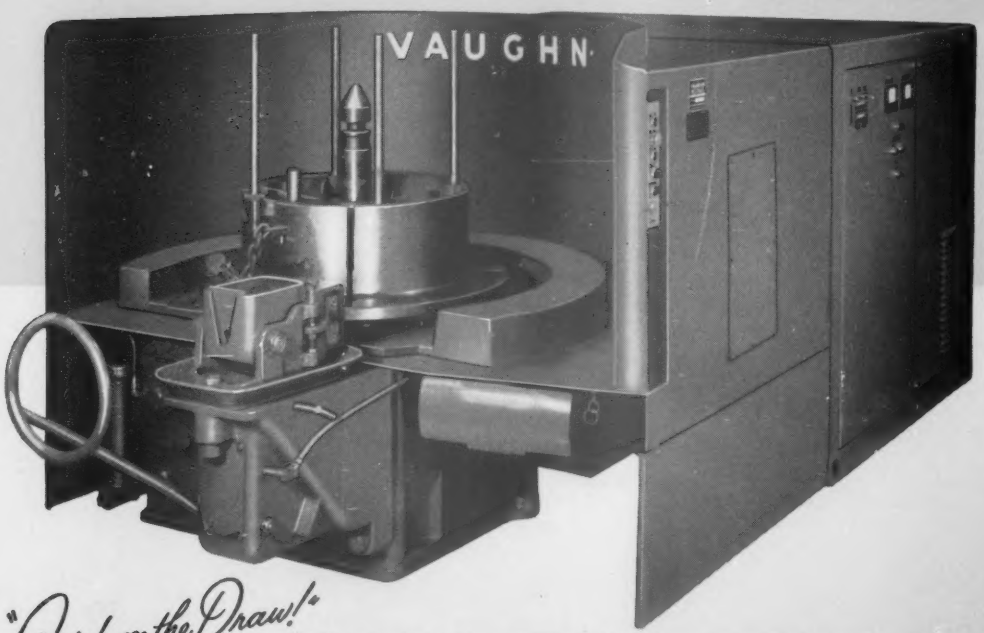
WIRE AND WIRE PRODUCTS

NOVEMBER 1961

Self-contained **PACKAGED PERFORMANCE**

in the **Motobloc®**



"Quick on the Draw!"

V®

COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys

The standout advantages of Vaughn packaged design are now at your service in the husky MOTOBLOC—*self-contained,* electrically and mechanically. All electrical equipment, including motor generator set, starter and control circuit, is now contained in a single compact unit. Installation costs are lower, inspection and maintenance easier than ever before. You should have the facts on this modern Vaughn development—*write us.*

THE VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U.S.A.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

COULTER & McKENZIE

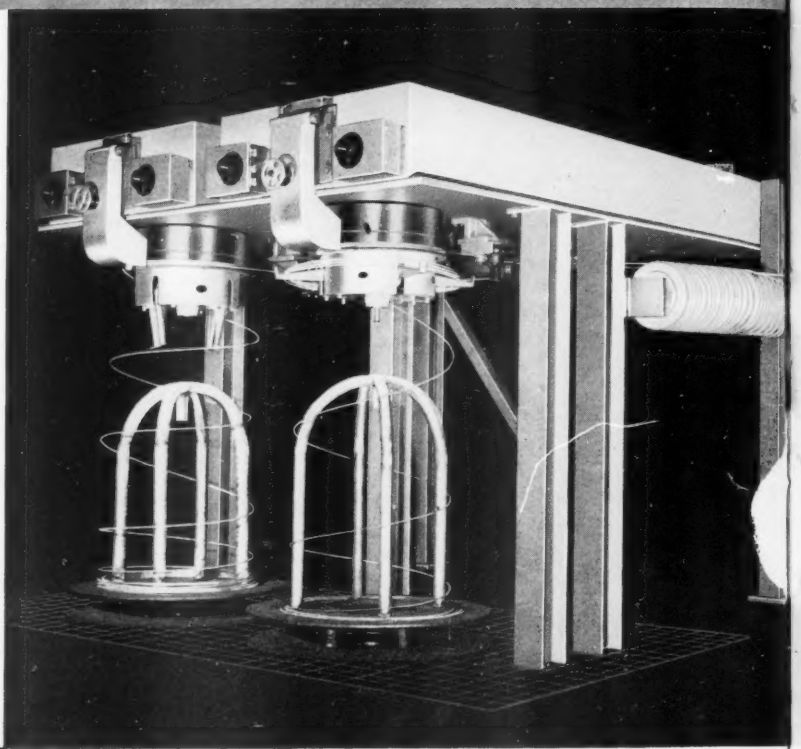
ANNOUNCES THE WIRE INDUSTRY'S MOST VERSATILE TAKE-UP & WIRE PACKAGING MACHINE!

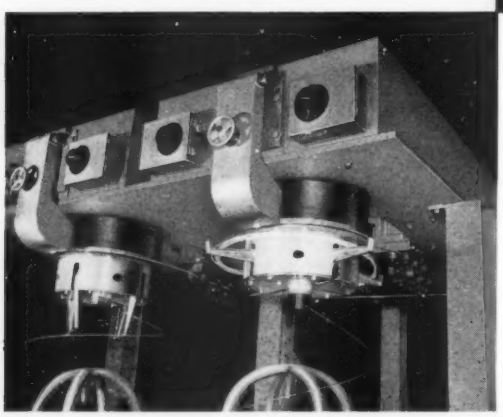
Vari-Coil

For PATENTING
ANNEALING
GALVANIZING
ENAMELING
TINNING
FINAL DRAW

- √ Non-Stop Package Changing
- √ Package Sizes to 4,000 lbs.
- √ Coil Diameters to 36″
- √ Speeds Infinitely Variable
- √ Wire Size to ⅜″ (.375″)
- √ Ferrous and Non-Ferrous Materials Including High Carbon Steel

THERE IS A SIZE FOR ALL APPLICATIONS. SINGLE OR MULTIPLE UNITS FOR YOUR INDIVIDUAL JOB.





For information concerning your application, please write or telephone.

1 INFINITELY VARIABLE RANGE OF COIL SIZES
a. All sizes wire from same capstan.
b. Current models with coil ranges 16″ to 26″ and 24″ to 36″ without changing blocks.
c. Coil sizes may be altered without stopping.

2 GREATER COIL WEIGHTS
a. Turn tables accommodate coils, drum paks and stems (200 to 1200 lbs.)
b. Oversize loads on handling pallets (1000 to 4000 lbs.)

3 INCREASED RANGE OF WIRE AND ROD SIZES
a. Precise cast control of fine wire to coarse rod.
b. No axial twist.

4 ACCUMULATOR HEAD PROVIDES INTERVAL FOR STRIPPING AT OPERATOR'S CONVENIENCE
a. Accumulator operating in conjunction with main take-up block is key to uninterrupted constant speed take-up.
b. Operator has 5 to 10 minutes accumulation time for stripping finished package from turn table.

This equipment manufactured under one of the following U. S. Patents 2,732,060; 2,868,474; 2,844,416; 2,868,268; 2,981,494 or others pending.

Barron & Crowther Ltd., Eastleigh, Hants, England. European Draw-Pak Licensee Idos Industries Ltd., Royston, Herts, England. Sales Agents.

35 UNION AVENUE
TELEPHONE EDISON 5-1101
LIEBER'S CODE "MACKENZIE"

THE COULTER & McKENZIE MACHINE CO., INC.

SINCE 1843 BRIDGEPORT 7, CONNECTICUT, U. S. A. INCORPORATED 1881

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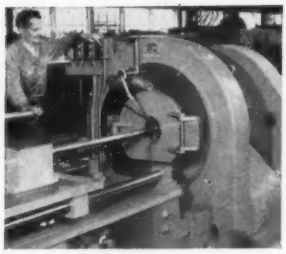
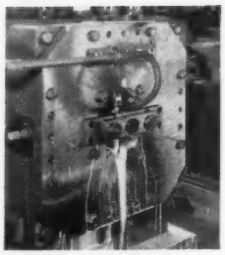
INDUSTRIAL CHEMICALS FOR METAL PROCESSING

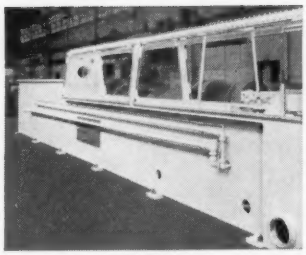
STANDARD INDUSTRIAL
COMPOUNDS COMPANY
FRANKFORT • • • ILLINOIS



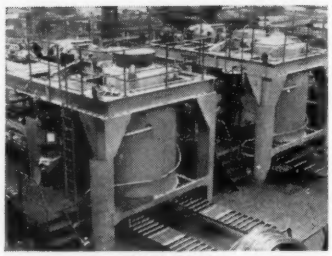
SWAGING MACHINES



TURKS HEADS

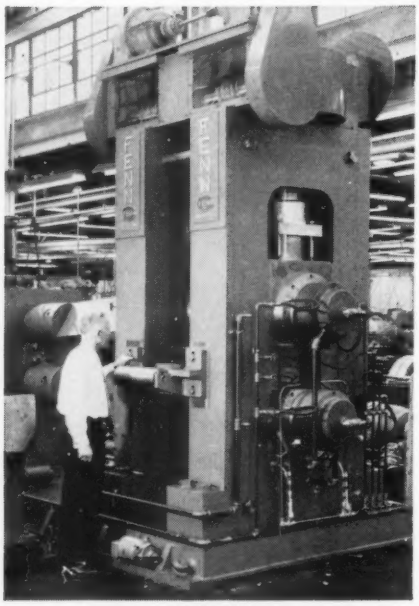


DRAW BENCHES



WIRE AND TUBE MILLS

PRECISION • PERFORMANCE • DEPENDABILITY



ROLLING MILLS

WIRE FLATTENING LINES

METAL FORMING MACHINES

that meet the challenges of the 60's

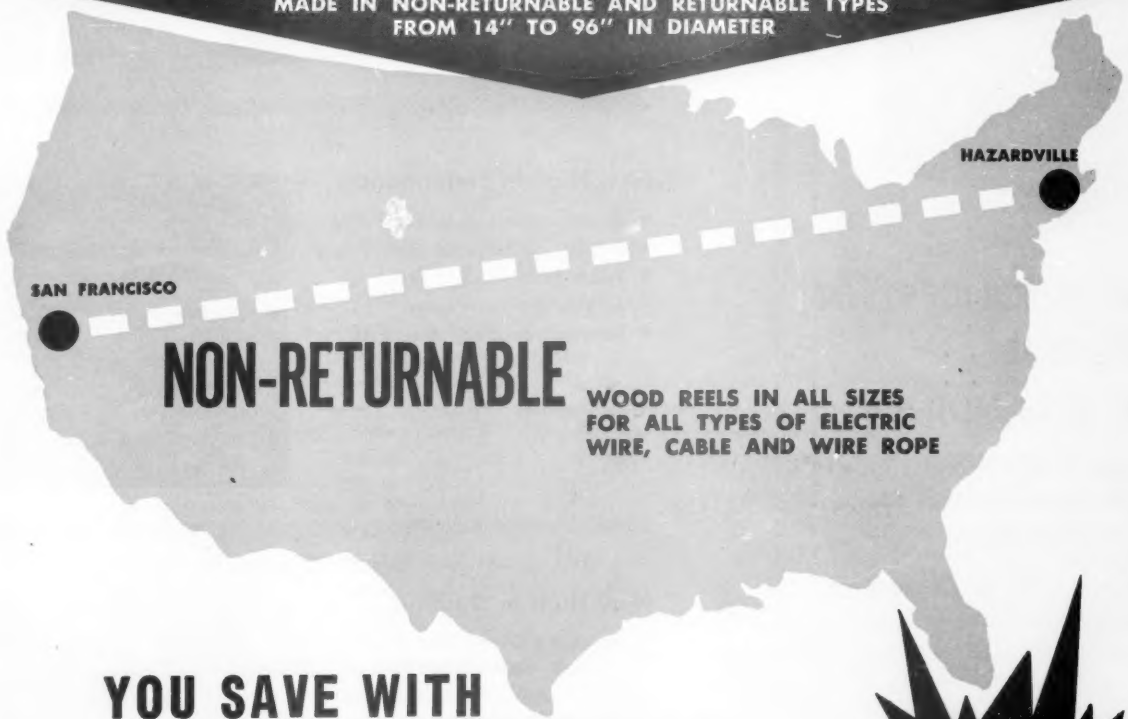
Within a relatively short span of years the name FENN has become well-known to users of metal forming equipment. In rolling mills . . . wire mills . . . in the nuclear industry . . . and wherever else ferrous or nonferrous metals are rolled, drawn, or formed to precision tolerances, Fenn machines are producing profits for their users. The extensive Fenn line is built on long experience in the manufacture of *precision* machinery and an equally long reputation for *performance* and *dependability*. Behind every Fenn machine is unexcelled engineering . . . from design to inplant checkout and continuing field service, plus an organization that strives to do every job better than the expected. Whatever your metal forming machinery requirements, you can depend upon your nearest Fenn representative for his experienced advice and practical help. Comprehensive literature will be promptly sent upon request. The Fenn Manufacturing Company, Fenn Road, Newington, Connecticut.

Designed and Built by FENN

A BOARDWALK FROM HAZARDVILLE TO SAN FRANCISCO

The wood used in the manufacture of BRIDGE REELS, in one average year's production, would make a boardwalk one-inch thick and twelve inches wide stretching over 3,000 miles across the country — OR — it would provide enough lumber to build 3,000 six-room houses — THAT'S QUITE AN OPERATION! The important deduction, however, is that BRIDGE REELS for WIRE, WIRE ROPE and CABLE are good enough to meet the exacting demands of most of the big wire plants of the country.

MADE IN NON-RETURNABLE AND RETURNABLE TYPES FROM 14" TO 96" IN DIAMETER

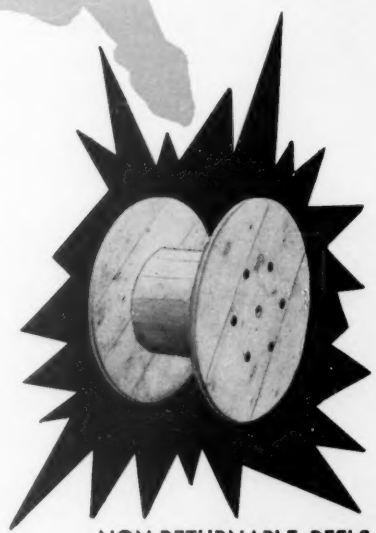


NON-RETURNABLE

WOOD REELS IN ALL SIZES FOR ALL TYPES OF ELECTRIC WIRE, CABLE AND WIRE ROPE

YOU SAVE WITH NON-RETURNABLES

- **Reduced Reel Investment**
- **Less Storage Space**
- **Lower Freight Costs**
- **No Repair Costs**
- **No Return Freight Charges**
- **No Bookkeeping**
- **No Deposits Needed**
- **No More Headaches!!**



NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST.

HIGH SPEED

SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 250 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

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"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"

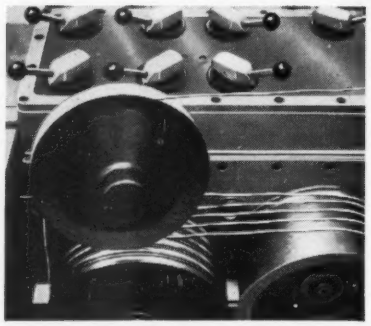
KRUPP

A NEW CONCEPT IN TELEPHONE WIRE STRANDING:

The Krupp Double Strander Type HDKT Specially Developed For Plastic And Paper Insulated Wires

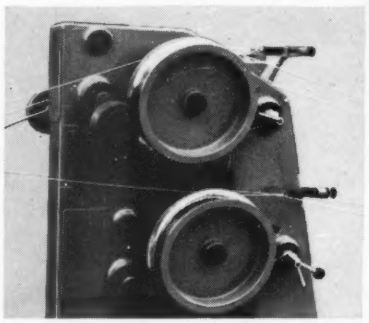
New High In Performance:

- 6 rotor speeds up to 1000 RPM
- 2 twists per rotor revolution
- Twists from 1 ¼" to 3 ½"
- 64 step precision gear
- Take-up spool 16" dia. x 10"



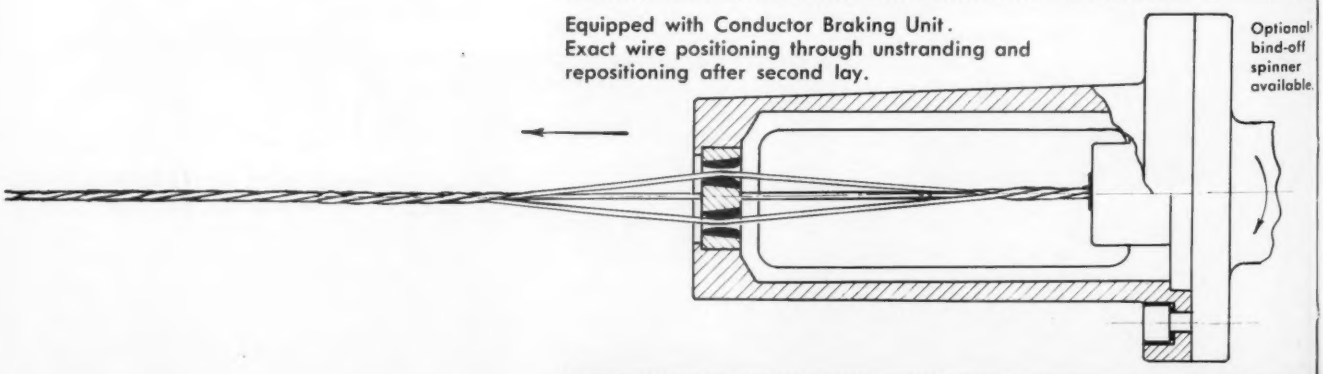
New High In Quality:

- Increased wire protection through improved guidance
- Double disc take-up balanced by separation of discs



Equipped with Conductor Braking Unit.
Exact wire positioning through unstranding and repositioning after second lay.

Optional bind-off spinner available.



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1811–1961

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WIRE AND WIRE PRODUCTS*

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 36 November, 1961 No. 11

Designated as Official Publication By The Wire Association

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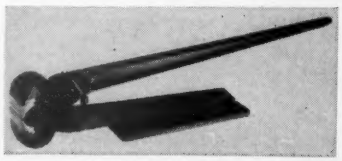
NEW

CAREW BENCH CUTTER



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One Hand Use

Doesn't tie up vise or other expensive makeshift

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Same replaceable tool steel jaws as our regular cutters

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made by

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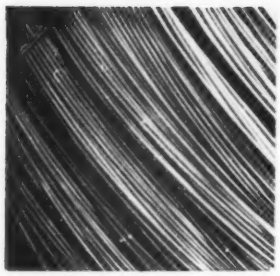
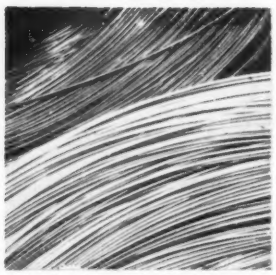
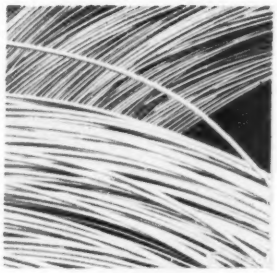
Please feel free to consult us with your wire cutting problems.

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HARD-DRAWN SPRING WIRE
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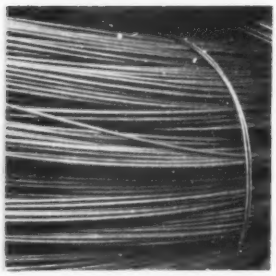

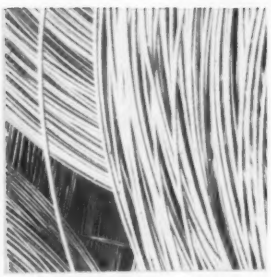
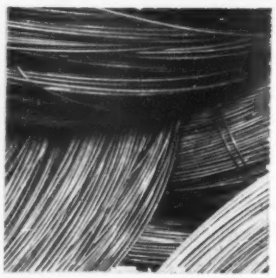

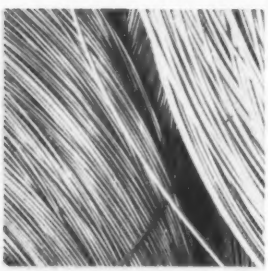

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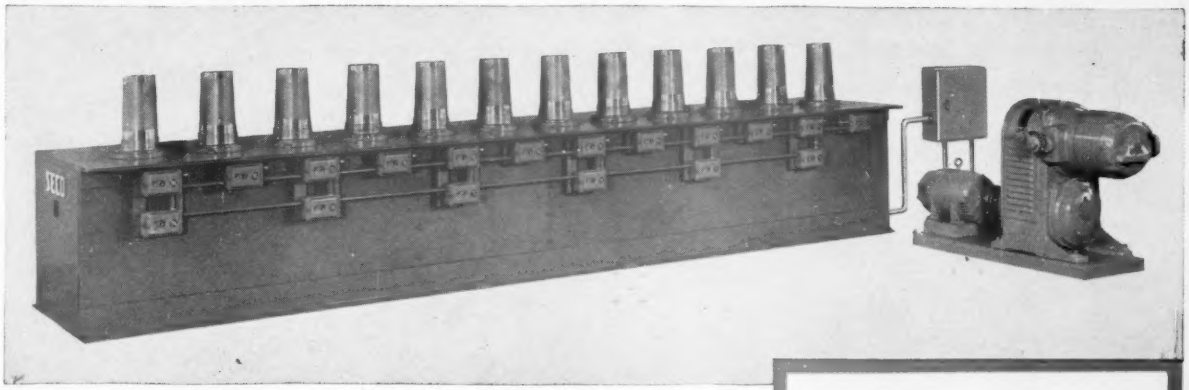
FUKUROMACHI, KITA-KU, TOKYO, JAPAN

SECO Fine wire TAKE-UP FRAMES

The "last-word" in wire-winding efficiency!



- **Simplified Design and Construction**
- **Synchronized Electrical Variable Speed**
- **Noiseless, Vibrationless Running**
- **Greatly Increased Operating Capacity**

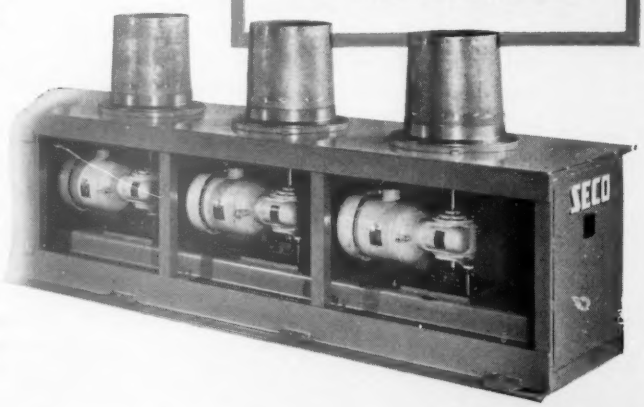
SECO builds take-up frames for handling fine gauge steel or non-ferrous wire on 8", 12", or 16" diameter blocks...with linear wire speeds up to 1,000 FPM or higher. Superior features include a multiple electrical drive system (alternating current) for synchronized electrical transmission of variable speed power.

This gives simultaneous speed changes to all spindle blocks, in ratios up to 5:1 or even 10:1 or higher. It provides push-button stop-start control to each of the gear motors driving each spindle block. Gone is the old bevel gearing, with manually operated clutches for starting and stopping the blocks.

SECO high production take-up frames are constructed to accommodate any number of spindles required. Frames with horizontal spindles can also be built. Call or write for complete information and data. Consultation invited—no obligation.

SHOWN ABOVE:
SECO Take-Up Frame and VARIDYNE Electrical Power Unit which provides synchronized variable speed to the multiple drives. AC current is employed throughout, and the VARIDYNE System "gears" all the drives together by electrical impulses.

SHOWN BELOW:
The AC squirrel-cage induction type gear motors which drive the spindle blocks through hollow bored shafts.



STEEL EQUIPMENT COMPANY
P. O. BOX 737, WARRENSVILLE STATION
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SE-9008 comes in coiled "hats" ready to feed *automatically* into your extruder. No premilling, no modifications, no special dies required.

Strips comes 2" wide, and either ½" or ¼" thick, whichever you require. Available for either hot air or steam vulcanization.

SE-9008 is excellent for power cable, fixture wire, motor and apparatus wire, and other commercial and military applications.

SE-9008 is moderately priced, and possesses good electrical and physical properties. Meets Underwriters Laboratory requirements for silicone rubber insulated fixture wire.

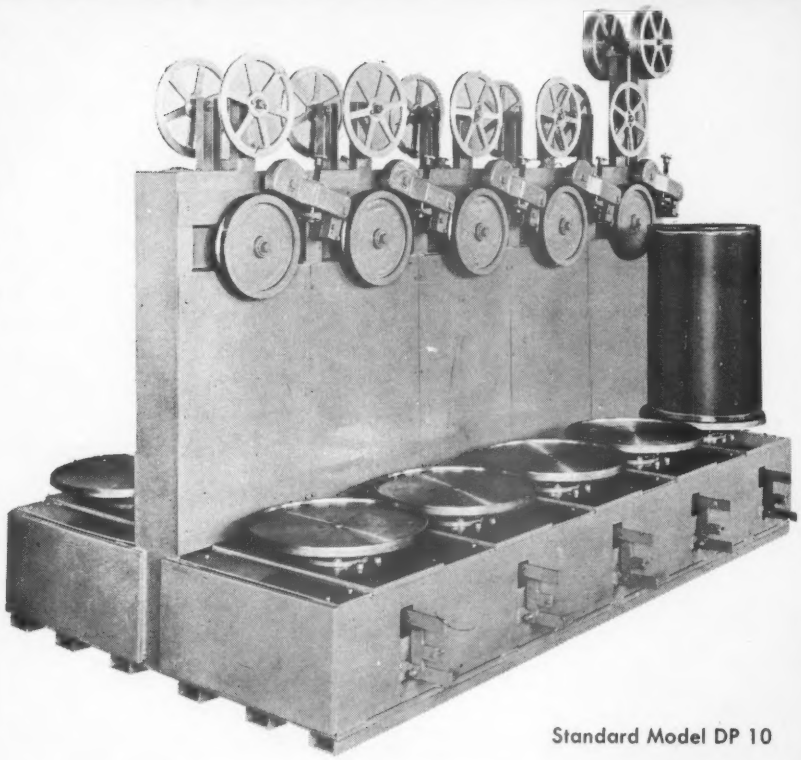
SE-9008 is another cost-saving product from General Electric, who supplies more silicone rubber for wire and cable insulation than all the other suppliers *combined!*

For more information on SE-9008, write: General Electric Company, Silicone Products Department, Section VV1151, Waterford, New York.

GENERAL ELECTRIC

COOK'S *universal* DRUM PACKER

gives you fast, dependable, continuous wire packing!



Standard Model DP 10

Individual clutch control units offer greater flexibility of operation. Enameling, tinning, galvanizing, patenting and other applications. Combination takeup unit permits wire packaging of coils from B&S gauge #6 (.162) to #24 (.0201) dia. or from 100 lb. capacity pails to 1000 lb. drums measuring up to 30" high and 20" or 22" dia. Infinite, variable speed control gives you the specific speed desired for each wire size, ranging from 20 to 120 ft. per minute. Packaging set-ups are optional, from spindle to spindle, without altering the machine which mounts 5 wires each side. Our complete line handles wire sizes from .0130" to .162" dia. If your needs are different from those above, your inquiry (specifying the application which interests you) will receive immediate attention from

COOK *Manufacturing Company*

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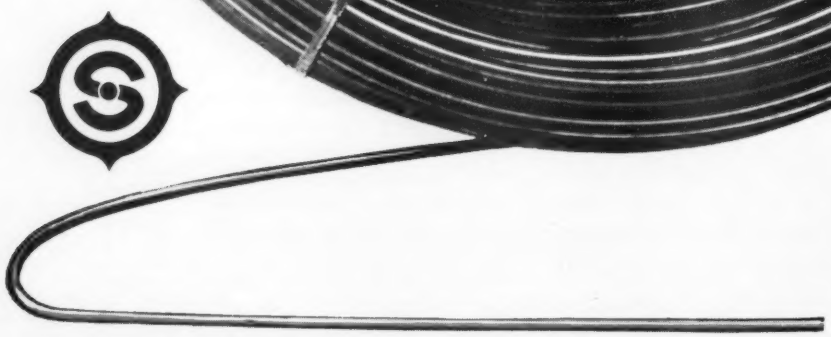
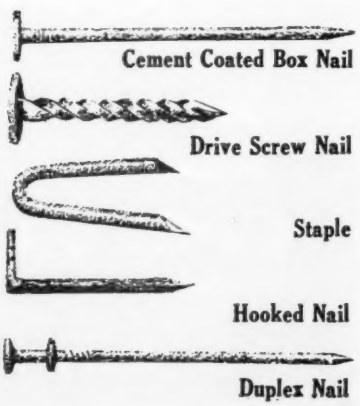
Wire rods in all gauges, finishes, tempers and analyses, and wire products of every description, including all kinds of nail, regular and special, to your specifications . . . specify YAWATA to fill your needs.





YAWATA IRON & STEEL CO., LTD.

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MACHINERY CORP.

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Wagner, Ficker & Schmid
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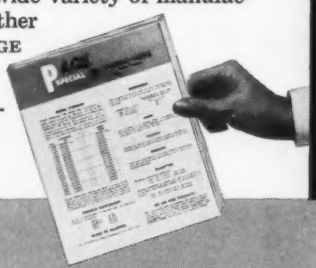
CUT WIRE COSTS UP TO 60%!

...with Page Special HB

If you are now using music wire, or if you have been prevented from using it because of its high cost, it makes good sense to investigate PAGE *Special* HB. In every case, the tensile strengths of *Special* HB approach those of music wire—and in sizes .090″ and coarser equals them! Moreover, *Special* HB costs as much as 60% less than music wire.

A hard-drawn, high-carbon steel wire, *Special* HB is available in galvanized or bright finishes and in diameters from .020″ to .162″. We'll be glad to send you the full story, including a detailed comparison of tensile strengths.

As America's leading special-purpose wire mill, PAGE can supply a wide variety of manufacturers wire items with just the tensile strength, ductility, finish and other properties you need. Tell us your requirements—we'll recommend a PAGE wire to help you reduce costs and improve your product.



Write us at Monessen, Pa. for Booklet **DH-107** on *Special* HB—or for information on what PAGE has to offer to meet your other wire requirements.

PAGE

the source for answers to wire problems

ACCO

PAGE STEEL AND WIRE DIVISION • AMERICAN CHAIN & CABLE COMPANY, INC.

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

COVER ALL YOUR VINYL JACKETING NEEDS WITH THIS PX-PLASTICIZER LINE-UP!

What's your vinyl insulation compounding problem? Whether it's in processing or in arriving at required end properties, PX Job Rated Plasticizers provide a sound solution . . . *at low cost.*

Pittsburgh *primary* plasticizers for the wire industry impart a balanced combination of desirable properties. Elongation retention, tensile strength, resistance to chemical breakdown and to water and oil immersion are some of their outstanding characteristics. And these PX Plasticizers can be compounded to cover temperature ranges from 60°C to 105°C.

Consider quality, check-out economy . . . you'll find that Pittsburgh PX Plasticizers are your best buy. For more PX Plasticizer information or for assistance in developing a solution to your compounding problems, call or drop us a note on your letterhead.

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PITTSBURGH CHEMICAL CO.

GRANT BUILDING PITTSBURGH 19, PA.

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CALL YOUR NEAREST PITTSBURGH CHEMICAL SALES OFFICE . . . PITTSBURGH, NEW YORK OR CHICAGO

Quality plus economy when you buy SUMITOMO steel wire rods

Rapid developments in the wire-product field have increased industry's demand for top-quality steel wire rods. Because of its international reputation for reliability, Sumitomo Metal supplies world markets — America in particular — with 7,000 tons of wire rods every month. To keep up with this export demand, Sumitomo Metal has added to its present facilities another new wire rod mill, completely equipped with the most modern machinery available.

Dimensions of Sumitomo Wire Rods

Diameter 5mm. (13/64") — 16mm. (5/8")
Weight Single Bundle
about 270 kgs. — 320 kgs.
600 lbs. — 700 lbs.
Compressed Bundle (6 coils)
about 1,620 kgs. — 1,920 kgs.
3,600 lbs. — 4,200 lbs.
Coil Dimensions on Request

LEADING PRODUCERS OF STEEL WIRE RODS, PIPE AND ROLLING STOCK PARTS

SUMITOMO METAL INDUSTRIES, LTD.

Head Office: Osaka, Japan
Cable Address: "SUMITOMOMETAL OSAKA"

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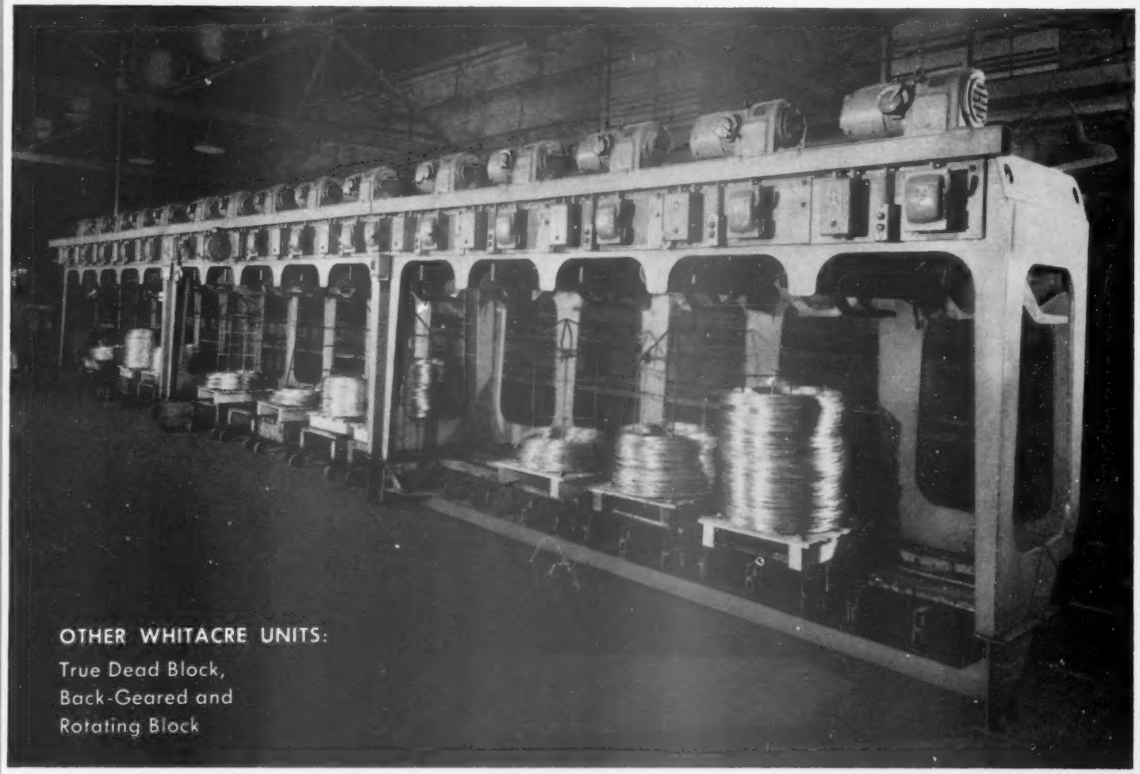
Cable Address: "SUMITMETAL NEWYORK"

Rugged Versatility
WHITACRE TAKE-UP FRAMES



Installation at Colorado Fuel and Iron Corp., Minnequa Works, Pueblo, Colo.

Whitacre Take-Up Frames have gained industry preference because they are rugged and versatile. Heavy duty construction permits 24 hour maintenance-free operation. Wide speed range and interchangeable block sizes allow processing a diversity of products into any type of container with perfect lay and cast. Investigate how Whitacre can lower your production costs.

OTHER TYPICAL INSTALLATIONS

Bethlehem Steel Corp.
U.S. Steel Corp.
Laclede Steel Company
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Western Electric Co.
Wire Machinery, Inc.

For Complete Information, Write:

WHITACRE CORPORATION

5649 Alhambra Ave. • Los Angeles 32, Calif. • CApitol 5-2476

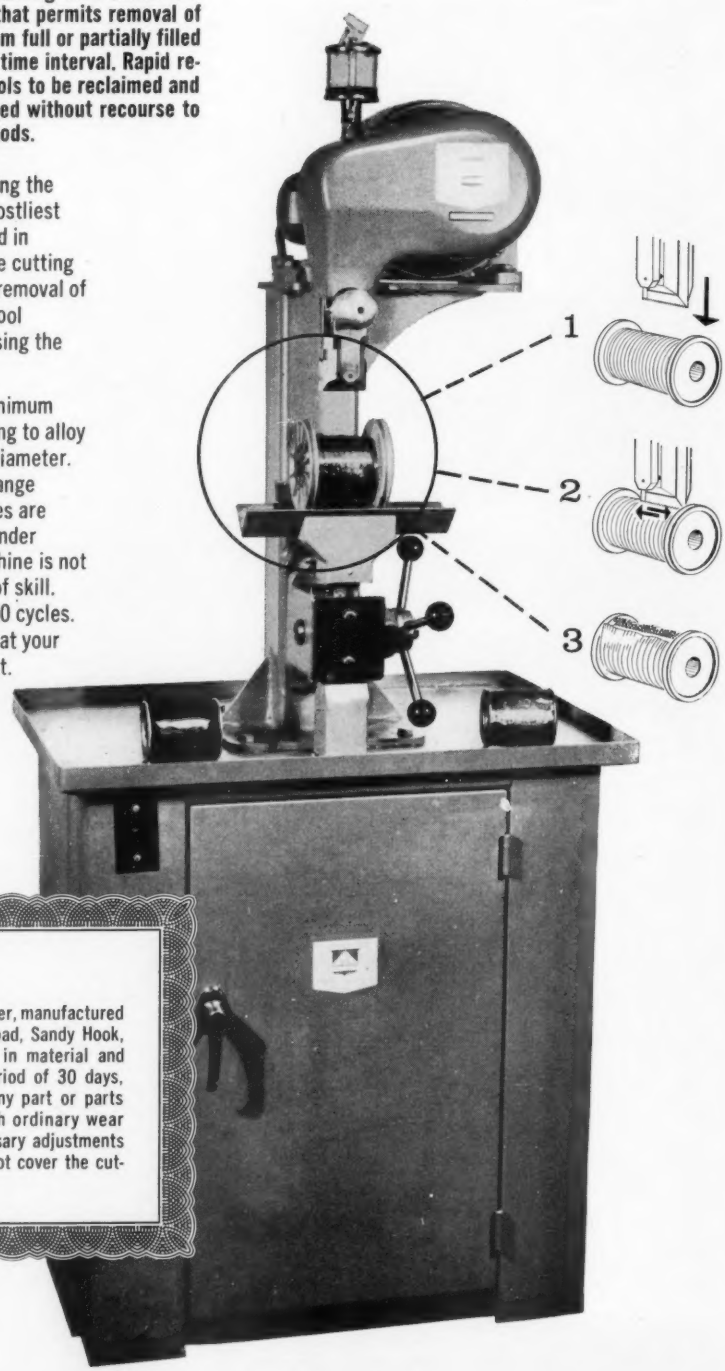
OSCILLATING WIRE CUTTER

SOLVES ONE OF THE COSTLIEST PROBLEMS IN THE INDUSTRY

The Watkins Oscillating Wire Cutter is a unique machine that permits removal of all wire alloys from full or partially filled spools in a short time interval. Rapid removal allows spools to be reclaimed and wire to be salvaged without recourse to costly hand methods.

Some of the largest companies in the country are using the Watkins Oscillating Wire Cutter to solve one of the costliest problems in the industry. Simple in design and rugged in construction, the Oscillating Wire Cutter has a unique cutting principle that shears wire turns on the spool, allows removal of the wire in seconds. Removal of the wire from the spool permits wire to be properly identified — thus increasing the scrap value and producing great savings.

The Standard machine, Model A, has a range from minimum diameter .0004" to maximum diameter .018" according to alloy and will handle spools from the smallest used to 8" diameter. The Heavy Duty model will handle spools up to 16" flange diameter, and wire diameter up to .050". Cutter blades are specially hardened and ground for good service life under reasonable care. The method of operation of the machine is not difficult to learn and does not require a high degree of skill. Electrical requirements are 220/440 volts, 3 phase, 60 cycles. The Standard machine is available for demonstration at your plant, within a reasonable distance, upon your request.



WARRANTY

We guarantee the Oscillating Wire Cutter, manufactured by R. S. Watkins & Sons, Inc., Glen Road, Sandy Hook, Connecticut, to be free from defects in material and workmanship. During the warranty period of 30 days, we agree to replace free of charge any part or parts which may become defective through ordinary wear and/or to advise regarding any necessary adjustments without charge. This guarantee does not cover the cutter blades.

R S WIRE MACHINES

R. S. WATKINS & SONS, INC.

Address inquiries to:

H. D. WATKINS Manufacturers Representative
Box 385 Hatboro, Penna.

Strong Restraining Influences... Roebling Hose Reinforcing Wire

Roebling Hose Wire, Hose Reinforcing Wire and Hose Wrapping Wire bear the stamp of Roebling's strict attention to constant uniformity. As with all Roebling wire products, each is wholly Roebling-made and Roebling-controlled, from open hearth to packaging. Tensile strength and forming qualities, finish and gage are of an excellence that proves itself in use.

Resistance to internal and external pressures and wear are what you look for in hose wires and what you pay for. With Roebling, you *get* them.

For further information on these and other Roebling quality products, write or call Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey.

Roebling... Your Product is better for it

ROEBLING

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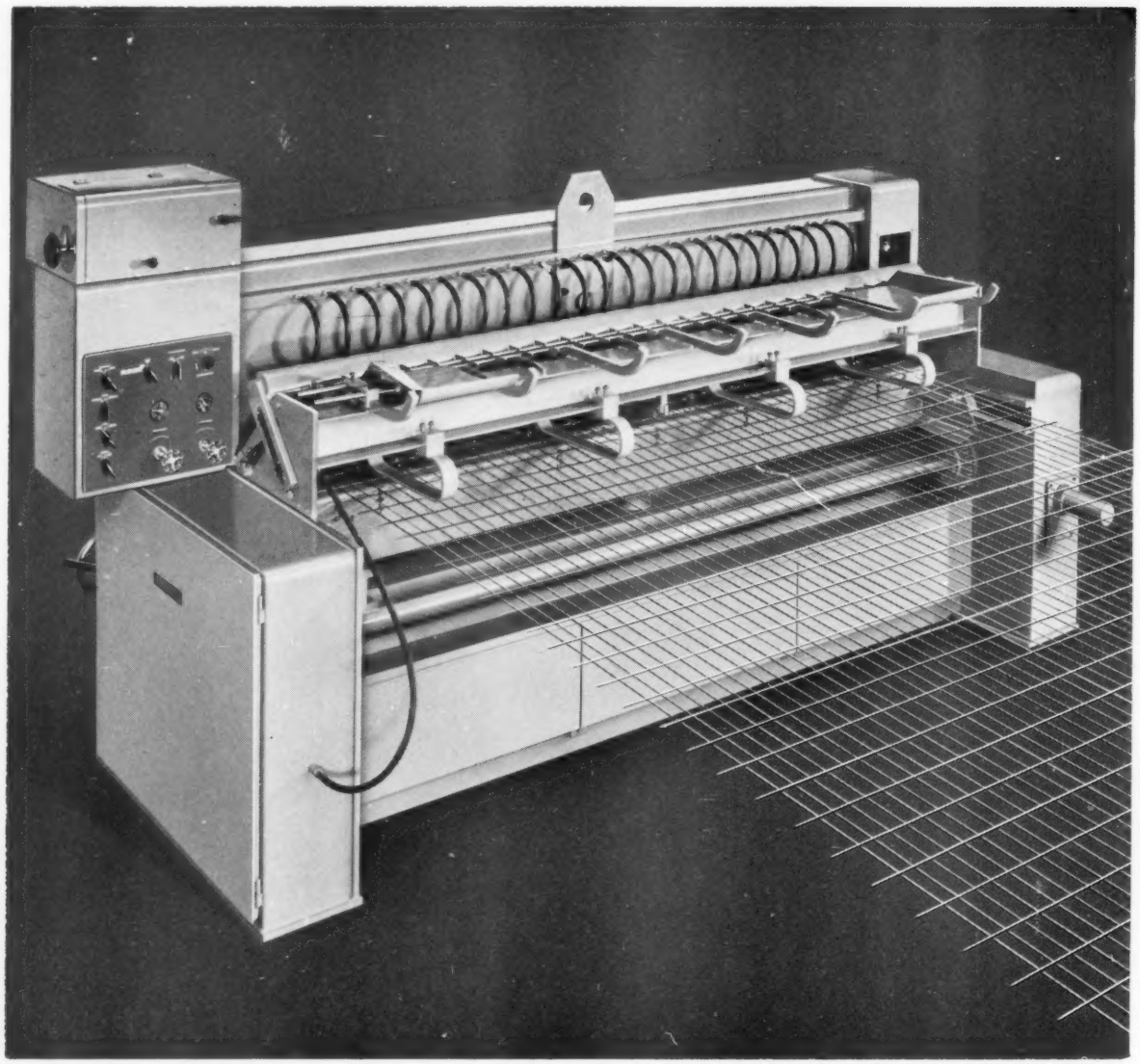
The Colorado Fuel and Iron Corporation

SCHLATTER

We have been specialising in the construction of resistance welding machines for nearly half a century. Fifteen years ago we produced the first mesh welding plant. This long experience has been utilised in the development of our modern mesh welding plants, and our manufacturing programme now includes a comprehensive range of machines.

Model 1 for light mesh in rolls and sheets	Wire 0.06—0.16 inch dia., width 79 inch.
Model 2 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 104 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 104 inch.
Model 3 for mild steel mesh in rolls	Wire 0.12—0.24 inch dia., width 147 inch.
for mild steel mesh in sheets	Wire 0.12—0.39 inch dia., width 147 inch.
Model 4 for mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 147 inch.
Model 5 for heavy mild steel mesh in sheets	Wire 0.16—0.47 inch dia., width 104 inch.



H. A. SCHLATTER Ltd. ZOLLIKON-ZURICH (Switzerland)

Manufacturers of Electric Welding Machines and Electronic Controls

Canadian Representative: Paul Reicher, Machinery and Equipment Ltd.,
600 Eglinton Ave. East, Suite 307 - IBM Building, Toronto 12, Ontario

Increase COLOR CODING OUTPUT

with the

Model 1250-20

LONG BARREL

VERTICAL EXTRUDER

Wire manufacturers with a coating problem will find the solution in this new vertical extruder.

This unit is complete and ready to run. It is designed to give you maximum versatility in operation. By means of a height adjustment and rotation of the top part, any setup job becomes routine.

The Model 1250-20 can be combined, in tandem, with any standard extruder in operations such as adding contrasting stripes or full color coating to insulation wire.

20:1 L/D Ratio
30-40 lbs./HR
Nominal Output

SIMULTANEOUS EXTRUSION OF DIFFERENT COLOR MATERIALS for:

- *Striping Indentification*
- *Color Coating*
- *Wire Insulation*

WE WILL MAKE THE DIES TO MEET YOUR SPECIFIC REQUIREMENTS. LET US KNOW YOUR EXTRUSION PROBLEM. WE WILL SOLVE IT AT NO ADDITIONAL COST.

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Designers and Builders of Specialized Equipment for the Extrusion Industry

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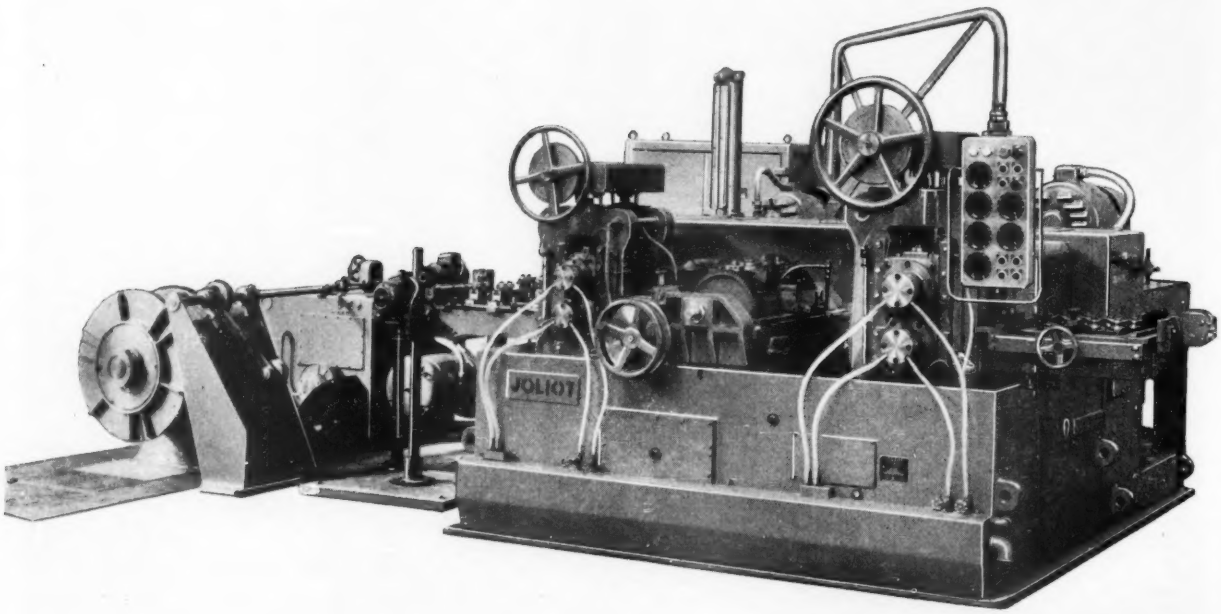
WIRE FLATTENING-MILLS

to make strips of very high quality
Such as wanted by wire enamellers



Our rolling lines, each designed according to your very needs, will produce directly the most accurate shapes, rectangles, squares, with perfectly melt-in radii, at high speeds and low-price.

MAXIMUM ACCURACY : Large cast-steel stands - Solid rolls-Oil flow-bearings - Very efficient cooling - Continuous gauges.

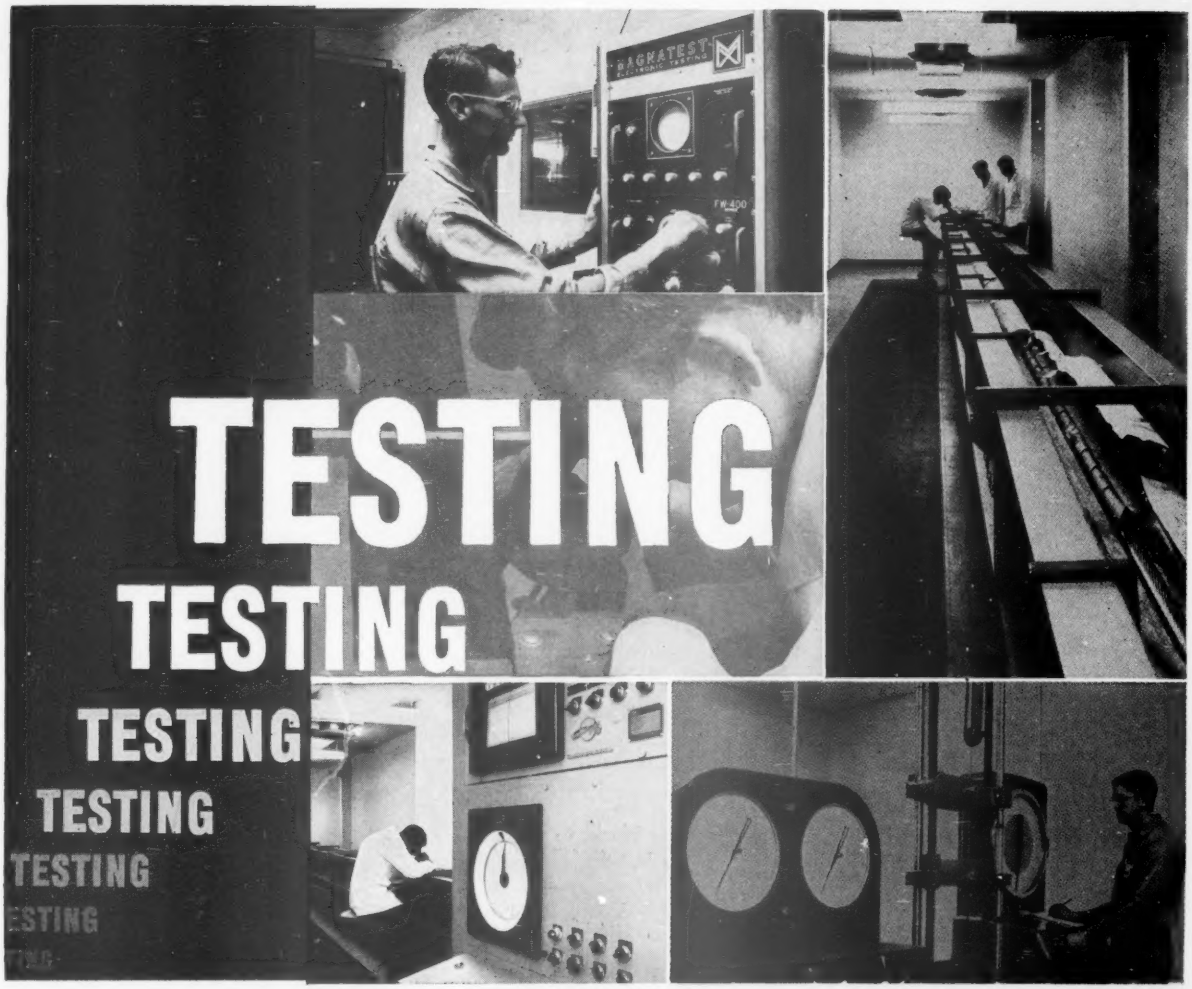
MAXIMUM STURDINESS : Heavy welded steel body - Ground treated gears in oil-tight boxes - Drive through A. C. cage motors - No collector rings nor brushes - No frictions drive.

MAXIMUM VERSATILITY : You can control the speed of each pair of rolls and, separately, the torque applied. So no slipage can occur nor too high pull on the strip; dancer rolls are not necessary.

Perfectly wound coils : on constant-pull coiler, hydraulic traversing; weight: up to one ton.

JOLIOT - 10, Rue aux Ours - PARIS-3e - (France)
Wire Drawing MACHINERY - Rolling Mills

Your enquiries will be welcome



to match Southwire Quality with Southwire Service

Increasing transmission and distribution loads require exacting specifications and quality. To assure you of the utmost quality, Southwire conducts a battery of tests on all products . . . from raw materials to finished goods.

A complete, modern laboratory — staffed with quality-conscious technicians — enables us to conduct a diversified and technically thorough testing of all our products. As many as 14 separate checks are made on a given product !

Quality at every manufacturing stage assures you of predicable performance in Southwire products—manufactured to exacting industry standards or to your own particular specifications.

Quality is *automatic* when you specify Southwire — and Southwire Service is unmatched anywhere.

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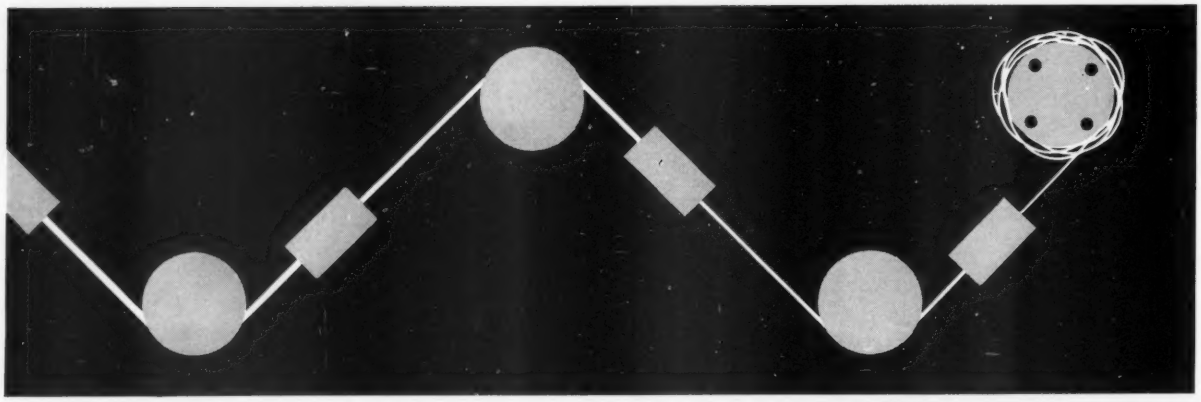
Elongation	Oxygen and Air Aging	Flame Tests
Repeated Stress-Strain	Ultimate Strength	Moisture Absorption
Spark	Conductivity	Capacitance
	Dielectric	

Southwire Company

SOUTHWIRE serves the world

Carrollton, Georgia — TErrace 2-6311

For the highest production you ever had . . . use Molysulfide® wire-drawing lubricants



Increase your drawing speeds ■ Cut costly die changes ■ Slash wire-breakage losses ■ Reduce power consumption ■ Get far greater reduction without intermediate annealing ■ Produce a stronger, better-quality wire product.

Users of lubricants containing Molysulfide commonly get NOT just one advantage, but a whole chain of production efficiencies and product improvements.

For example, typical wire-drawers have obtained results like these:

- Greatly increased speeds. Increases of from 1200 to 1500 fpm on stainless wire, as compared with previous speeds of 400 to 500 fpm. An actual increase of 300%!
- Important die economies. One company found it could dry draw stainless to 1/64″ where wet drawing with conventional lubricants would necessitate going to diamond dies at 3/64″. Result: 50% more reduction without changing dies.
- Reduced power consumption. Using a Molysulfide lubricant, a prominent wire drawer reduced 1/4″ stainless rod to 1/8″ wire rod at conventional speeds and under pressures approaching the yield point of steel. Reduction—75%. Power saving—10 to 15%.
- Far greater reductions. Recently, "Moly" made possible the reduction of 0.218″ Grade 434 stainless rod to 0.045″ wire without intermediate annealing. A 95.7% reduction, working hard drawn stock!
- Fewer rejects and less downtime. Using an MoS_2 lubricant, a drawer of carbon steel wire decreased wire breakage about 10%. Die changes also were reduced—from at least once a week to once every 2 or 3 weeks.
- Improved product quality. A maker of premium wire rope found that MoS_2 was deposited in a microscopic layer on the wire. As a result, less heat was generated, brittleness was avoided, and wire toughness was much improved. In the finished rope, MoS_2 also acted as a lubricant, preventing metal-to-metal contact as the rope flexed, and greatly prolonging rope life.

Superior results have been obtained by many companies producing aluminum core wire, various kinds of high carbon wire, spring wire, specialty metal wires, and other process wires. What this lubricant additive has done for others, it may well do for you. For information on wire drawing lubricants containing Molysulfide, simply call or write us.

CLIMAX MOLYBDENUM

CLIMAX MOLYBDENUM COMPANY

a division of AMERICAN METAL CLIMAX, INC.

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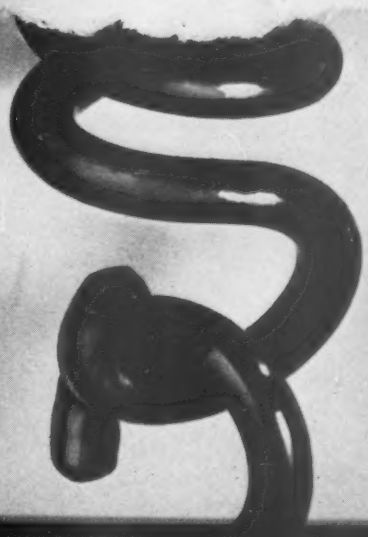
Even-tempered spring wire means better springs. Wire makers who consider quality important assure themselves of complete and uniform treatment with modern Lee Wilson continuous heat treating lines. *Lee Wilson Engineering Co., Inc., 20005 Lake Road, Cleveland 16, Ohio.*



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AMERICA'S FOREMOST BUILDERS OF WIRE HEAT TREATING EQUIPMEN

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Satisfaction guaranteed

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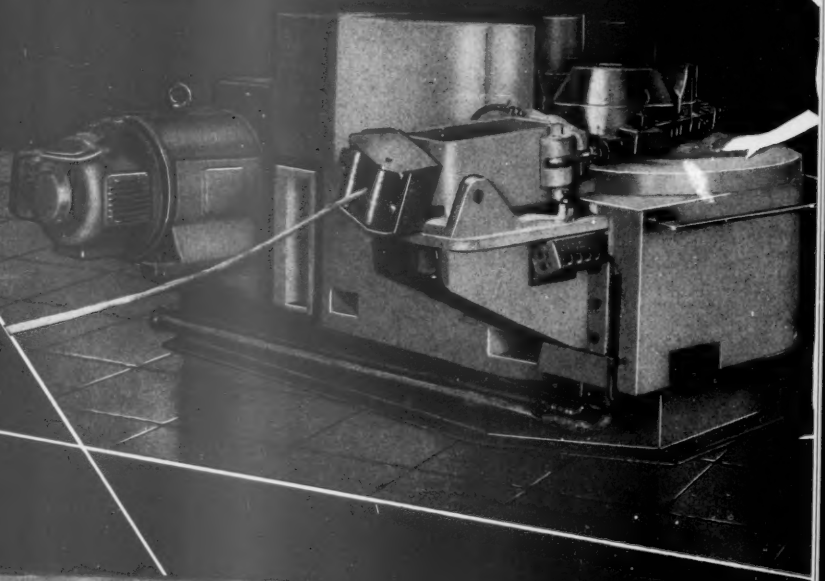

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BUYERS' GUIDE?

We are beginning to compile the **1962** Edition and must count on YOUR cooperation to keep your listings up-to-date. It is to your advantage to have them accurate.

New products, deletions of products, changes in corporate names and addresses and so forth, should be supplied before the first of the year, if, there have been any. Now's the time to send them in.

These involve

RODS • WIRE • WIRE PRODUCTS • MACHINERY
EQUIPMENT • SUPPLIES • AND SERVICES

There is no charge for listing products and services in light face type. It is a matter of having the directory complete and accurate.

Advertisers' listings will be set in bold face type. If you are not now advertising in the BUYERS' GUIDE and wish to reinforce your listings with advertising, send for a rate card.

The BUYERS' GUIDE is the only directory published in the U.S.A. covering all branches of the Wire Industry. It is widely used as a reference for locating sources of supply. Your cooperation in having YOUR listings correct is solicited.

WIRE AND WIRE PRODUCTS

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SHUSTER

PRESENTS THE NEW
MODEL 200V TWIN ARBOR
TORSION WIRE-STRAIGHTENING & CUTTING MACHINE!

STRAIGHTENS WIRE SO IT STAYS STRAIGHT!

The new Shuster Twin-Arbor "Torsion" wire-straightening machine produces wire that can be formed or spring-coiled with positive uniformity. Now save time in tooling — eliminate rejects caused by torque in wire. Low price — high production.

100% FASTER ON MANY HIGH TENSILE WIRES

● 25 gauge to 14 gauge in mild steel ● .015 to 16 gauge in spring wire. ● 25 to 150 F.P.M. with Guaranteed Production Rates. ● 200 cuts per minute — up to 8". ● One motor — infinite variable speed — electric target.
Companion model 300V — Handles high tensile wire from 19 gauge to 3/32".

NEW LITERATURE AVAILABLE . . . WRITE TODAY!

There are more Shusters being built . . . and in use throughout the world . . . than all other machines of this type.

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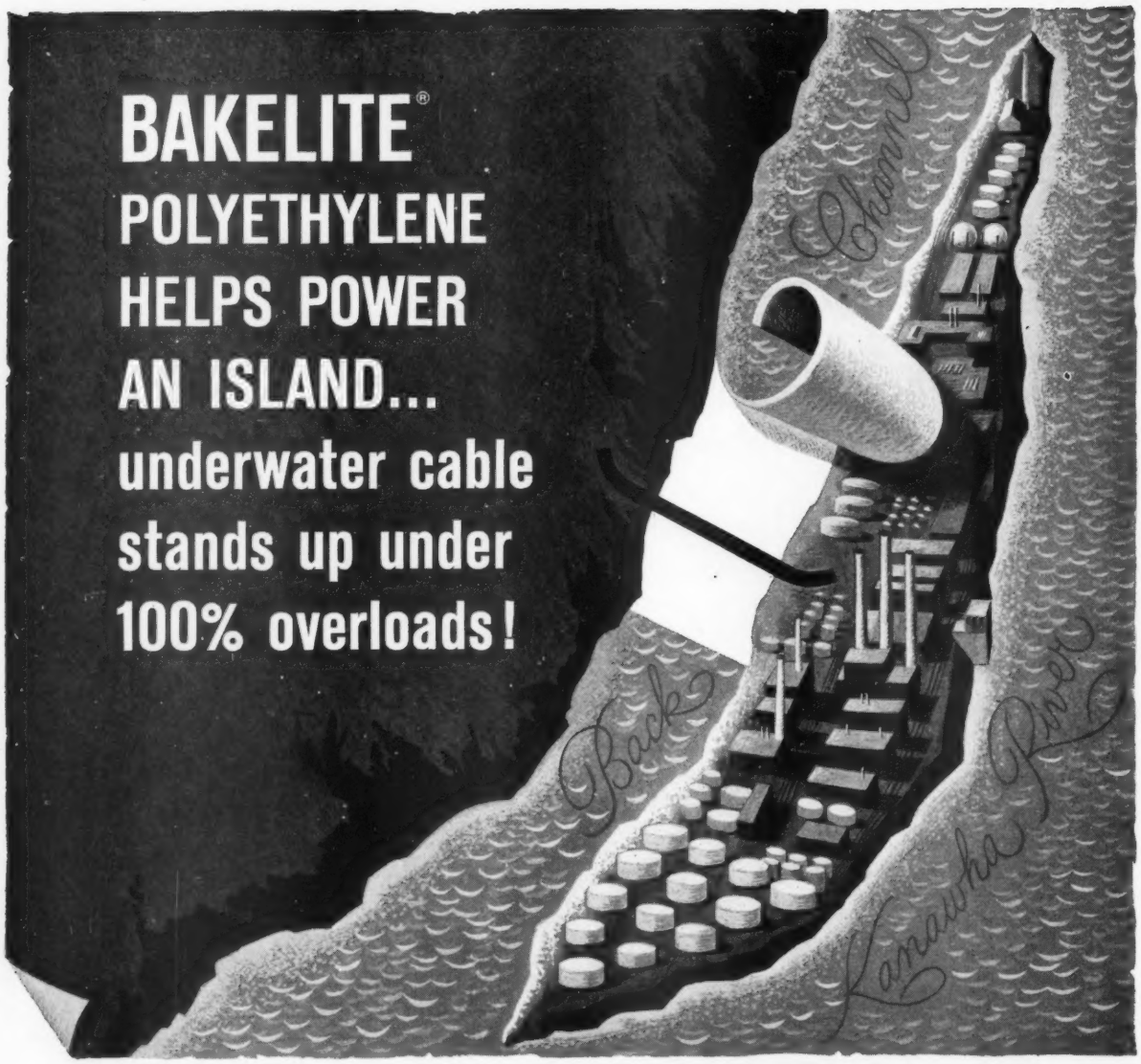

Termination of power cable insulated and jacketed with BAKELITE polyethylene in a powerhouse cubicle on the mainland.

So. CHARLESTON, W. VA.: In 1956, Union Carbide Chemicals Company found an easy solution to bringing electric power from the mainland to Blaine Island. The submarine carrier: a single 15-KV load transfer cable, insulated and jacketed with durable BAKELITE polyethylene, laid along the bottom of a channel . . . without additional shielding.

Although continuously exposed to severe physical and chemical tests, the BAKELITE insulated-jacketed cable has provided failure-free 'round-the-clock power . . . despite wide load variations. Even a recorded 100% overload lasting several seconds didn't interrupt service or damage the cable.

When you have a power cable problem, it makes good sense to choose cable insulated and jacketed with BAKELITE polyethylene. Tough, durable, highly resistant to moisture and cracking, and an excellent low-loss dielectric, BAKELITE polyethylene is designed to provide optimum performance under severe conditions. Flexible and light in weight, polyethylene insulated-jacketed cables are easy to install, require no protective ducts or conduits.

Want more information? Write Union Carbide Plastics Company, Division of Union Carbide Corporation, Dept. KL-160K Park Avenue, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE PLASTICS

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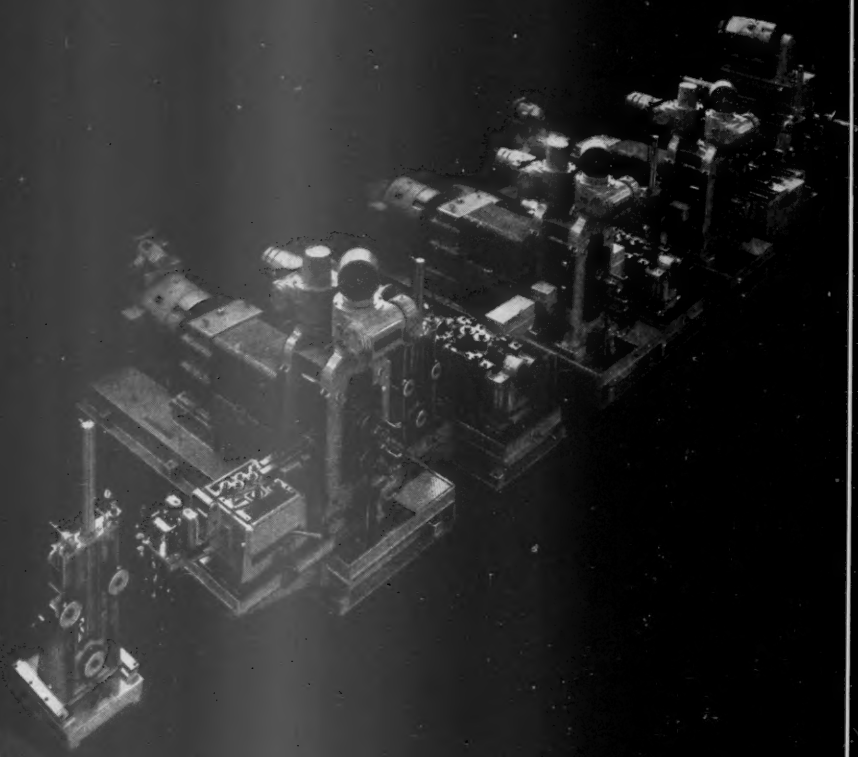

HIGHER SPEEDS

+ INCREASED POWER

+ GREATER FLEXIBILITY

= LOWER WIRE FLATTENING COSTS

Torrington Flat Wire Mill lines are built with new dimensions of ruggedness, precision, and operator control. From starting round to finished flat speeds can be as high as 3500 FPM with tolerances of plus or minus .00025″ in thickness and .0005″ in width. This entire operation is controlled from a central station. *Torrington's method means more finished wire in less passes and anneals between the round and the finished flat.* The engineers who designed this equipment will study your specific requirements and make recommendations. For lower wire flattening costs write to Torrington now.

TORRINGTON
MANUFACTURING COMPANY
MACHINE DIVISION, TORRINGTON, CONNECTICUT

pro-fax®

STEPS UP PERFORMANCE OF CABLE INSULATING SYSTEM

A new high in telephone cable insulation performance has been achieved with Pro-fax polypropylene. Reason: this new plastic has qualities unmatched by other insulating materials.

In producing the insulating system, foamed Pro-fax, extruded around each wire, forms a sheath with superior electrical properties. The same insulating excellence is inherent in the moisture resistant Pro-fax tape* produced by Extrudo-Film Corporation, which is wrapped around the core.

Hercules Pro-fax polypropylene has tenacious high-strength that withstands mechanical abuse. It also rates high in cut-through and heat resistance. All these characteristics contribute to the efficiency and low cost of the insulating system. When insulation must retain its properties on long-term exposure to elevated temperatures, Hercules can supply Pro-fax formulations that assure the ultimate in performance.

The pioneer and still the leading producer of polypropylene, Hercules is headquarters for reliable counsel and service based on broad experience in supplying modern olefins for insulating purposes. Phone or write.

QP61-7

HERCULES POWDER COMPANY

Polymers Department
Hercules Tower, 910 Market Street, Wilmington 99, Delaware

**For further information on "Electro-Film" insulating tape made with Pro-fax, call or write Extrudo-Film Corporation, 1841 Broadway, New York 23, N. Y.*

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your dependable supplier of

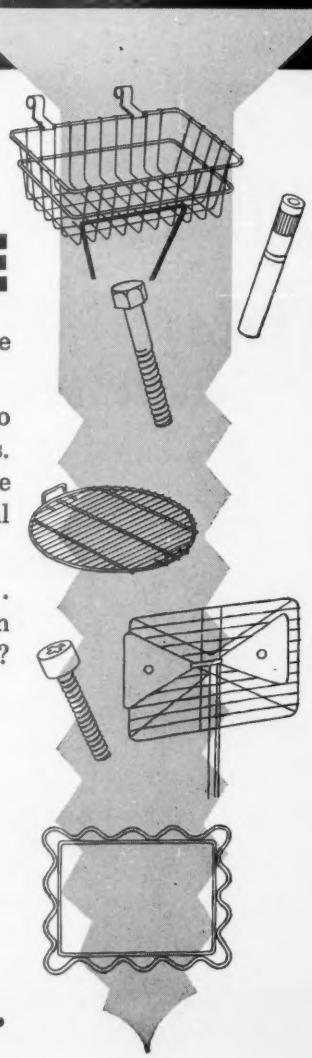
MANUFACTURERS' WIRE

Consider making Northwestern your "partner" in fabricating the products or component parts you sell.

Let us show you how our 82 years of experience enables us to provide the *right* temper and *right* finish to *exact* size specifications. Let us work with you to provide standard or special purpose qualities, or custom wire to be developed by our metallurgical staff to meet your exact needs.

Present users with whom we are "partners" report longer die life . . . greater production efficiency . . . better quality of product when working with Northwestern wire. May we be equally helpful to you?

All Northwestern wire is made exclusively from electric furnace carbon steel.



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THESE ARE AMONG THE MANY FINISHES WE PRODUCE: GALVANIZED • POT ANNEALED • BRIGHT • EXTRA SMOOTH CLEAN BRIGHT • ANNEALED (LIME, BRIGHT, BLACK)

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If there is any question in your mind,

ASK OUR ADVERTISERS.

They spent over $200,000.00 for advertising in 1961 in

WIRE AND WIRE PRODUCTS

WHY?

- **Because the magazine is the only paper published in the United States exclusively for the Wire Industry.**
- **Because it gives you full coverage of the field.**
- **Because our readers are responsive.**
- **Because there is little or no waste circulation.**

We invite you to get the facts.

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J. E. Donnellan, Vice President
299 Main Street, Stamford, Conn.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

HIGH SPEED

BETTER ACCURACY...
GREATER PRODUCTION
No. 8-FHA Travel-Cut, Automatic High-Speed Wire Straightening and Cutting Machine, Capacity 5/32" to 3/8" diameter mild steel or 5/16" alloy and high carbon. Speed 95 to 450 FPM.
TIMKEN BEARING EQUIPPED

Never before has a machine been made for straightening and cutting wire which offers the wide range of controls for accuracy and high speed.

- Electric Trip and Wichita Low Inertia Air Clutch and Air Brake.
- Redesigned High-Speed Flying-Shear Cut-off.
- Dual-Center Rotary Straightener Arbor with two-speed control through Dual-Speed Motor.
- Individual Air-Controlled Feed Pressure Adjustment for each Feed Housing.
- Combination Sliding-Gear Feed and Flywheel Transmission.

Lewis manufactures over 50 models of straightening and cutting machines to handle round wire from .012" to 1" and from 1/16" to 13/16" in square, hex and flat. Write or call us for information on your requirements.

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MODERNIZE YOUR PREHEATING PROCESS WITH A

NEW

BRUSHLESS • FRICTION-FREE

ONE MODEL FOR ALL NON-FERROUS WIRE SIZES AT ALL LINE SPEEDS

ALL-ELECTRIC

WALCO Wire PREHEATER

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- Continuous uniform wire pre-heating
- Portable • Easy to install
- Positive heat control at any given speed
- Increases production • Inexpensive to operate
- Stepless heat range with single dial control
- Synchronizes with all other equipment
- Maintenance-free • Only 2 moving parts
- Completely enclosed for safety
- Adjustable to all wire lines
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SPECIFICATIONS

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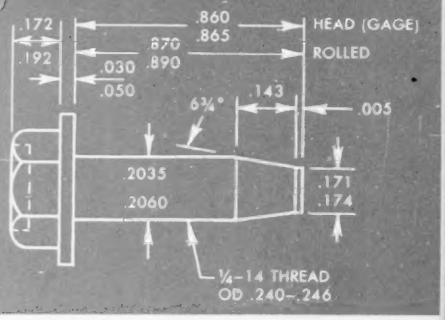

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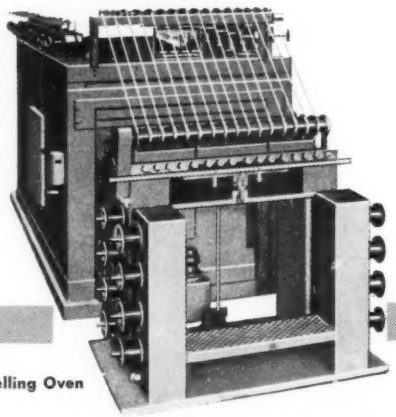

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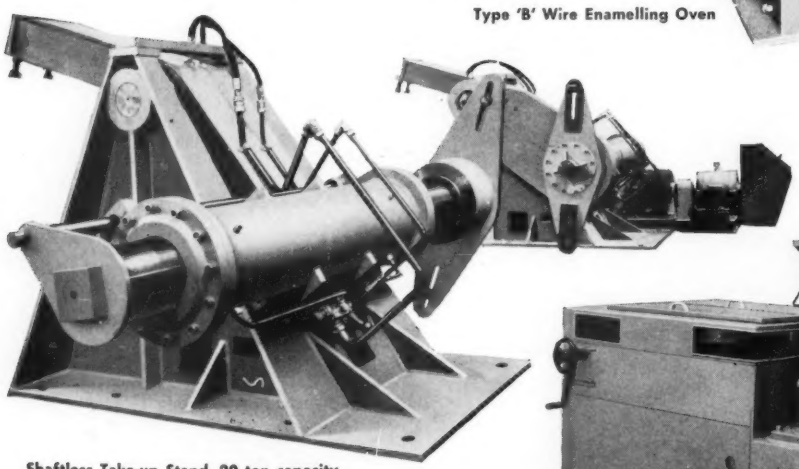

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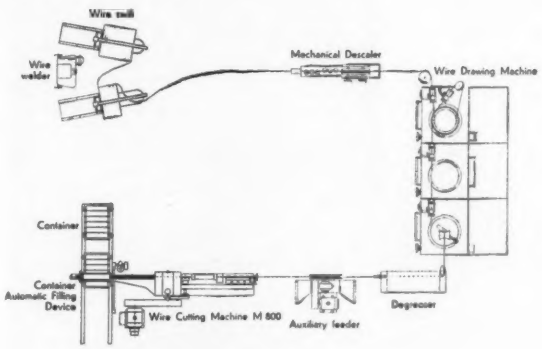

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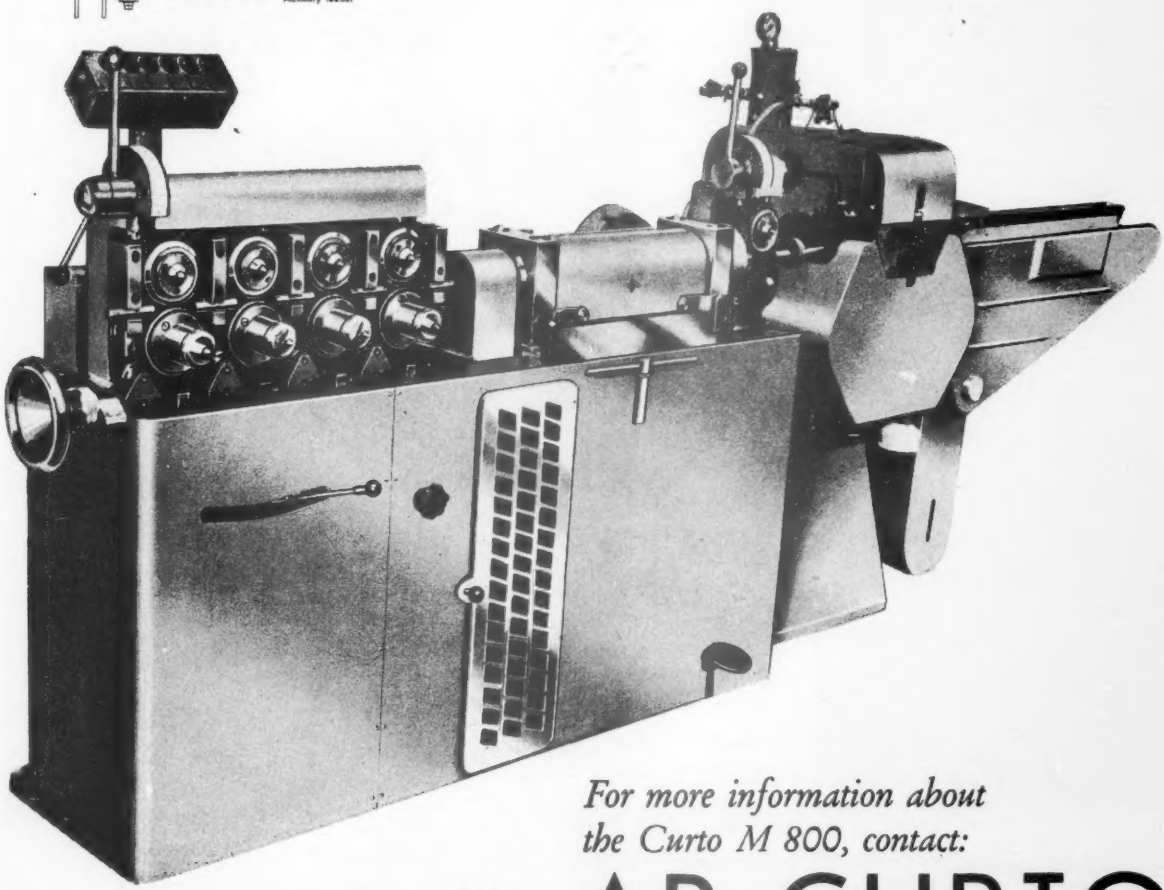

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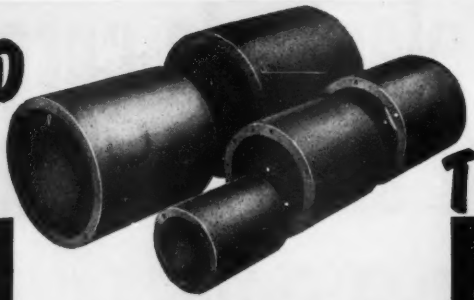

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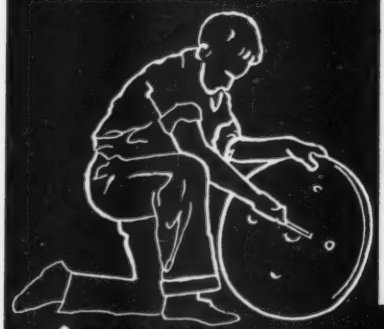

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Besides TRAVERSES, every type of REEL and SPOOL—returnable and non-returnable in all materials is made by HUBBARD for shipping and shop use.

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GARRETT, INDIANA

The Wire Outlook

Business throughout the nation has been growing slowly but steadily, with all types of products abundantly available.

The retail trade, after a period of lagging behind other elements of growth in the economy, now shows signs of picking up. Installment buying of new cars and appliances rose early in September to 42.6 billion dollars, $26 million higher than in July. Earlier in the year credit buying had been declining for some months.

Inventories of both raw materials and finished goods are rising and factory stocks are a billion dollars less than a year ago. Inventories, however, are not expected to get out of hand as they did prior to the last recession.

Coupled with this, it is reported that imports fell off in August by 8 percent from the July level, but totalled a billion and a quarter dollars in volume. July imports were the highest in 22 months. Exported goods are big business for overseas producers, but a source of concern for many wire mills.

Employment rose sharply through the Summer and early Fall. Jobs rose by 450,000 in September over August, the Labor Department reporting that the number of men out of work for over half a year had dropped 150,000. A total of 6.8 percent of the labor force still is unemployed, however. We have to bear in mind that our unemployment figures are padded.

The auto strikes have somewhat slowed the business rise, but when these are cleared away, automotive buying will resume, since dealers report active interest in the 1962 crop of new cars.

The Consumer Price Index continues to rise a little each month, often by not more than one-tenth of one percent. At the end of any one year this mounts up. This index, compiled by the Bureau of Labor Statistics, is the nearest thing we have to a cost-of-living index. Food has been dropping, but many other items have gone up slightly; most of the increases have come from medical services, rent, electricity, gasoline, barber and beauty shop charges, and the like.

While the majority of American industry groups have gained, there are a few that are behind the general trend. The metalworking industry is one, although production machinery sales are showing up fairly well, indicating a feeling of need for continued modernization.

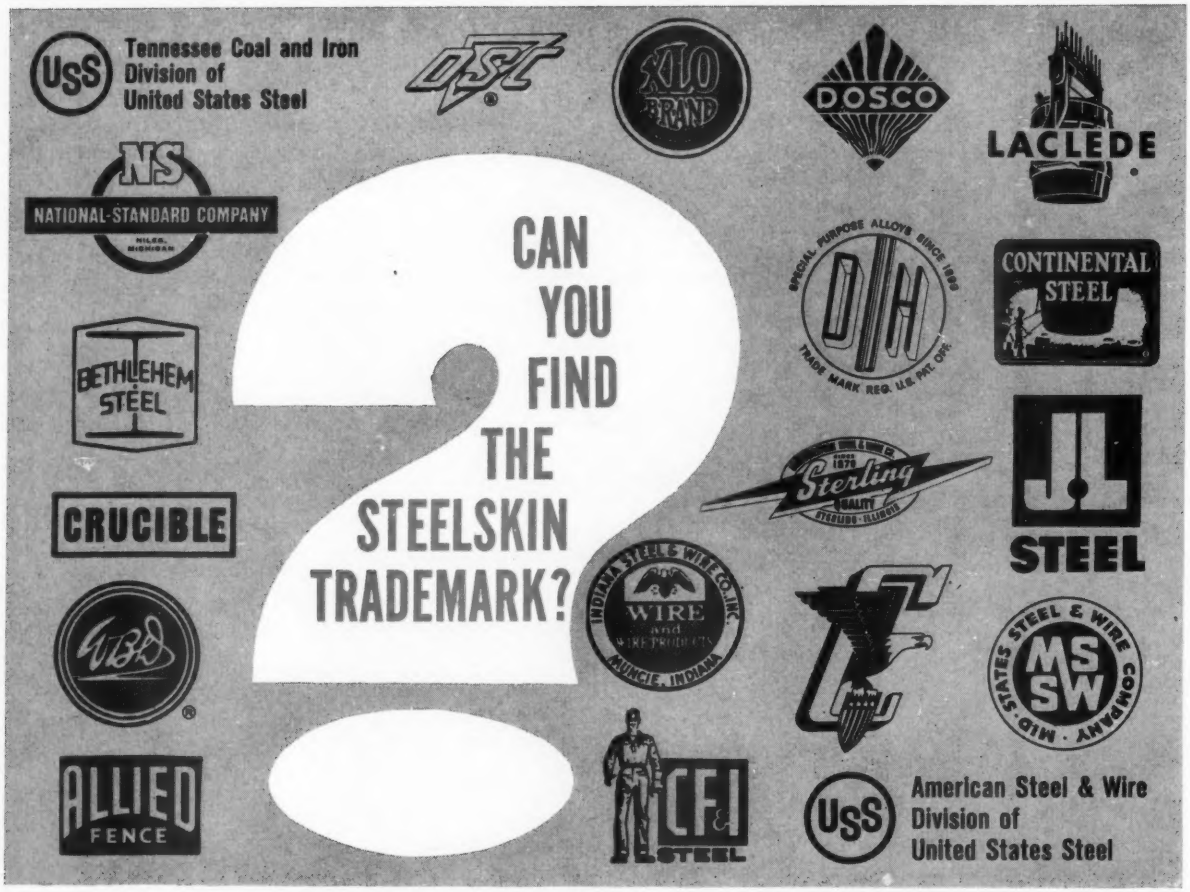
Building construction is strong. The Department of Commerce visualizes an even better year in 1962, with a rise of 4 percent to a total of $60 billions, of which $41 billion will be private and $18 billion public building.

In the wire industry merchant wire products are in easy supply and will continue to fall off until next Spring. Industrial grades of carbon steel wire are more active, especially for spring wire. Wire rod shipments are moving better. Manufacturers' wire sales also have risen. October wire sales, in general, are expected to be the best of the year so far, with mills operating at 65 percent or better of capacity.

While world conditions continue to be in a turmoil, thanks to Red instigations, business should continue to prosper, considerably spurred by defense spending, with the Gross National Product rising to $525 billion in the last quarter and possibly approaching $600 billion next year.

Edmund D. Eckels

EDITOR



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Vol. 36 November, 1961 No. 11

Surface Defect Detection

by

Harry F. Ammarell
Plant Metallurgist
Cold Drawing

and

Richard B. Moyer
Nondestructive Testing
Engineer

The Carpenter Steel Company
Reading, Pennsylvania

This paper was prepared for presentation at the Annual Convention of The Wire Association at French Lick, Indiana, on October 24, 1961.

Mr. Ammarell was graduated from Albright College with a B.S. degree. Prior to his present position he was employed as a chemist by The Beryllium Corp. and as a Production Supervisor by the E. I. du Pont de Nemours and Co., Inc. Mr. Ammarell is a member of The Wire Association and the American Society for Metals.

Mr. Moyer was graduated from Lehigh University with a B.S. degree in Engineering Physics. Prior to his present position he was employed in various capacities by Gilbert Associates, Inc., Textile Machine Works and Curtiss Propeller Division, Curtiss-Wright Corp. He is a member of ASM and is past Chairman of the Philadelphia Section, Society for Nondestructive Testing. Mr. Moyer is a Task Force Chairman of ASTM, E-7 Sub. 6 and has served on committees for the American Iron and Steel Institute.

Surface defects on hot rolled steel throughout the years have created two major problems for the steel producer; these are defect prevention and defect detection.

* * *

Men associated with the manufacture of steel products have always thought positively on this subject and have endeavored to use all existing techniques to prevent defects.

* * *

Some of the methods used to prevent defects are: (1) proper control of the chemistry of the steel, (2) special methods of ingot, bloom, and billet preparation, (3) controlled heating prior to hot working or rolling, (4) correct design of rolling mills.

* * *

However, even with the many improved production and quality control techniques, steel still arrives at the wire mill with some surface defects.

* * *

The purchaser of wire mill products is now insisting more and more that the producer supply him with a product that will approach 100% reliability. This trend has placed a tremendous responsibility and burden on the men in charge of quality control in the wire mill, since they are unable to know when or where their rods are going to be defective.

* * *

Time-honored methods of testing have given a good level of quality but never the assurance of complete reliability. The most commonly used method is destructive testing of coil ends but it has an inherent sampling limitation. Figure 1 shows an inspector examining a group of etched coil ends for surface defects. Visual inspection of the pickled coils affords 100% sampling but is extremely slow and subject to human error. Two inspectors are shown in Figure 2 searching a pickled coil ring by ring.

* * *

Some years ago the first equipment for rapid, automatic nondestructive testing came into use; this was an electronic instrument

Fig. 1 — Etched Coil End Inspection. * *

Fig. 2 — Pickled Coil Inspection. * * *

employing eddy current principles for locating surface defects on straight length steel of both magnetic and non-magnetic grades. These pieces of equipment have improved the reliability of the shipped product.

* * *

With this equipment, the bar is transported through a stationary encircling search coil assembly. Figure 3 is a sketch depicting the essential features of this arrangement. High frequency electric currents are induced circumferentially in the steel. Because of the "skin effect" associated with high frequencies these induced eddy currents tend to be concentrated at the surface and immediate sub-surface. This surface concentration of eddy currents is shown in Figure 4.

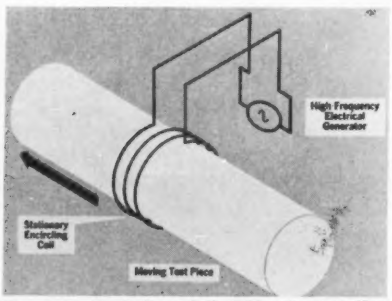

Fig. 3 — Encircling Coil Eddy Current Test Equipment. * * * * * * *

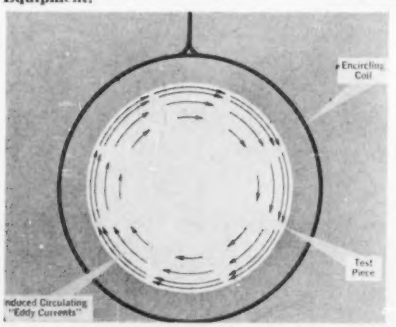

Fig. 4 — Surface Concentration of Eddy Currents.

These eddy currents set up a magnetic field surrounding the bar. This magnetic field can be detected by either a separate sensing coil or by the original coil that induced the eddy currents. In either case, the signals from the sensing coil can be analyzed by electronic circuitry to reflect the nature of the eddy currents. The character of the eddy currents is altered by variations in conductivity, permeability, and physical geometry of the steel within the coil. Conditions which can affect conductivity and/or permeability include:

Alloy composition
Internal stresses
Metallurgical structure, such as
Case depth,
Grain size,
Hardness or heat treat condition,
Homogeneity, etc.

Conditions affecting physical geometry are due to —

Diameter variations
Ovality
Presence of mechanical defects such as
Cracks,
Holes,
Seams,
Splits, etc.

The electronic circuitry can be designed to emphasize one or more of these conditions at the expense of the others. In the application for surface defect detection the apparatus is so designed that two adjacent sections of the bar are compared. Since all of the variables except defects contribute only gradual changes, this equipment is quite sensitive to the abrupt influences caused by defects. However, if a uniform defect such as a seam extends the entire length of the bar, it could be undetected. Another limitation of this equipment is its inability to detect defects at the extreme ends of the bar.

* * *

Figure 5 illustrates commercial equipment capable of locating defects in magnetic materials.

* * *

As a seam detector, the instrument for magnetic grades will locate seams whose depth is 1% or more of bar diameter, for example, a .010″ seam on a 1″ diameter bar. Seams of lesser

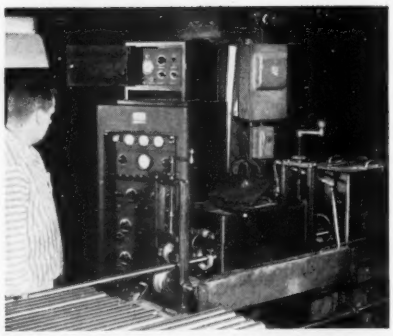

Fig. 5 — Eddy Current Equipment for Magnetic Grades. * * * * * * * *

depth may be detected but not with consistent reliability. The bars for proper testing should be uniformly stressed by heat treating, cold drawing, or straightening. The instrument for non-magnetic steel is more sensitive and will detect seams in the order of .005″ per inch of bar diameter. The entire bar is inspected with the exception of the extreme ends. The bars must be completely non-magnetic as small amounts of magnetism will affect the reliability of the test results. It is possible in rare cases for a series of conditions, such as heat treatment, stress level, permeability irregularity, chemistry, etc., to combine to make seam detection difficult. Crack detection however is not subject to this limitation.

* * *

Figure 6 is an illustration of commercial eddy current equipment for non-magnetic grades.

Fig. 6 — Eddy Current Equipment for Non-Magnetic Grades. * * * * * *

On both pieces of equipment a bar of the particular lot of steel to be tested is used as a standard in setting up the equipment. The operator usually checks the defect indications by locating and measuring the depth of the defects to gain experience and im-

prove his technique in equipment operation. This procedure enables him to establish a fairly accurate correlation of meter readings or oscilloscope patterns with the nature and size of defects. With this information, the controls of the automatic alarm circuitry may be intelligently adjusted to suit the specification involved.

* * *

Both types of stationary search coil equipment are excellent with respect to crack detection, and for this reason alone are worth their salt in any mill. They are essential in mills manufacturing heat treated steels or free-machining steels, both of which are sensitive to cracking.

* * *

Recently, the electronic industry has given the wire producers the rotating probe search coil. This is another step closer to perfection in product control.

* * *

In the rotating search coil approach, the probe spins about the advancing bar or wire, scanning a helical or spiral path around the steel. Figure 7 is a sketch showing the operation of the rotating search coil. Since adjacent

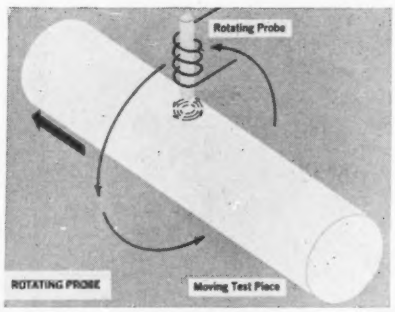

Fig. 7 — Rotating Search Coil. * * *

angular segments are compared, this method will not overlook a long uniform seam. This system is potentially more sensitive than the stationary encircling search coil because a defect represents a larger percentage of the field of view of the narrow angle scanning probe as compared with the full circumference aspect of the stationary coil. These relative areas of influence are sketched in Figure 8. A limitation of this arrangement is that

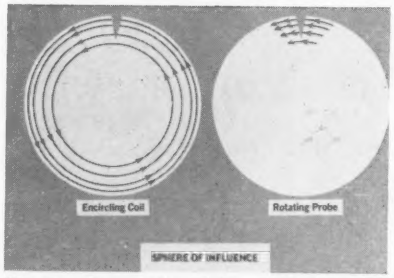

Fig. 8 — Comparative Fields of View. * *

a very short defect that lies completely between two spiral scans or within the lead of the helix may be overlooked. Figure 9 shows the special conditions under which a short defect might be missed. The lead, of course, is a function of the speed of probe rotation and of steel advancement past the inspection station.

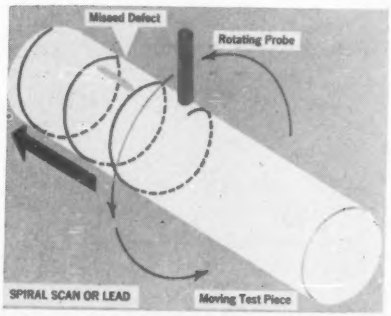

Fig. 9 — Missed Defect within the Lead. *

This method of inspection for surface defects may be used on steel in coil form, and as such will be available to the purchasers of roller and ball steel, hot and cold heading wire as well as many others who require surface defect reliability in manufacturing their product. The heading industry has had rapid growth in recent years. Speed of production, greater utilization of raw material, and improved strength characteristics of produce have made the process economically desirable. A tremendous inspection and separation problem is created when wire with intermittent defects is fed into the heading machine.

* * *

A principal application of the rotating search coil has been in association with the draw block; however, attachments for through feed centerless grinders are also on the market. When attached to the draw block, a complete coil may be tested while it is being cold drawn. Figure 10 is a photograph of such an application of commercial equipment mounted on a wire draw block. The unique feature of the rotating probe is that it is adaptable to all types of steel as well as non-ferrous alloys.

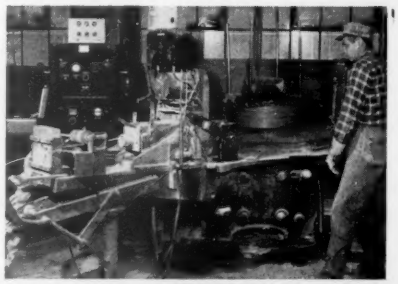

Fig. 10 — Commercial Rotating Probe Equipment Mounted on a Draw Block. * * *

The sensitivity of this equipment is excellent as it will detect seams in excess of .004" and will frequently do better on certain alloys. The sensitivity is not related to the diameter of the steel.

* * *

As with the eddy current equipment employing stationary search coils, this innovation is provided with similar controllable alarm circuits and readout devices. The equipment may be augmented with many auxiliaries such as (1) a spray paint can which is activated as defective steel passes through the tester thus painting the defective steel as it passes on to the block, (2) a digital counter which will give a percent defective on a footage basis, (3) a recorder which gives defect severity indications as well as defect location with respect to coil ends, (4) mechanical marking equipment to skive the wire at the defective locations which will be rejected prior to use in a subsequent operation.

* * *

The reliability of the rotating search probe is constantly being improved. Where a large number of grades of steel are inspected, it is difficult to establish electronic settings without

(*Please turn to page* 1600)

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1955

Patented NON-returnable Reel

Reel-less Packages (1,000# and more without a reel)

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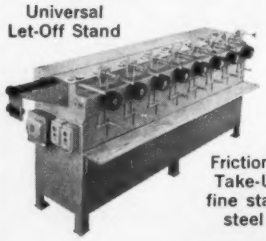

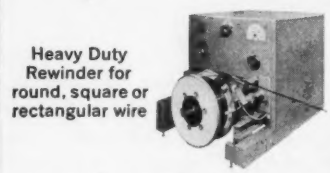

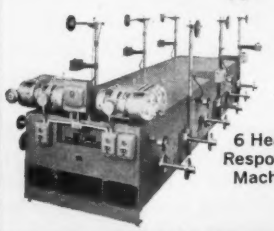

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Rolling Flat Wire in High-Speed Multi-Stand Mills

by Frank Bares
Manager, Mill Machinery
Machine Division
The Torrington Manufacturing Company
Torrington, Connecticut

This paper was presented at the Annual Convention of The Wire Association on October 24, 1961, at French Lick, Indiana.

Many thousands of tons of flat wire or tape are produced annually for transformers of all sizes and for a variety of other end uses. There has been in the last few years a gradual tightening of users' tolerance specifications on width, thickness and corner radii of flat wire and requirements on surface condition. With the reduction in wire inventories enforced by his customers in slower market periods, the volume flat-wire producer must then carefully evaluate his production methods and equipment in order to develop improved quality while maintaining a competitive cost and fast delivery of a wide variety of sizes.

* * *

While other steps are needed in the manufacture of flat wire, rolling of the round wire (usually hard-drawn shaved copper) on a flat wire mill is the basic and most critical operation. Although the function of a flat wire mill is simple enough, product quality and manufacturing cost depend mainly on the mill's own design and performance characteristics.

* * *

About ten years ago, a midwestern wire manufacturer began operating two high-speed flat wire mills (such as the machine in Figure 1) to handle all flat-wire production. Although single-stand mills with lower, fixed rolling speeds would have cost considerably less, it was felt then — and has since been borne out in practice — that the high-speed, multi-stand mill best equipped the company to serve its customers' requirements.

* * *

Tolerances in Flat Wire Mills

Dimensional tolerances normally produced on both mills are ±.0005 in. on thickness and ±.001 in. on width, although in numerous cases closer tolerances have been specified by users and readily obtained on these machines. These tolerances are maintained for flat-wire dimensions up to the capacity limit of the machines — .400 in. and 1.000 in. in thickness and width, respectively, on the larger mill. In contrast, ASTM Publication No. B-48-55, "ASTM Standards on Metallic Electrical Conductors," recommends maximum tolerances of ±.001 for dimensions up to .100 in. and one per cent over .100 in.

Production Capacity and Cost

A high production capacity — and the ability to ship special, unstocked sizes on short notice — has been achieved because (1) the mill speeds are high and continuously variable, (2) there are three mill stands and two edging stands in sequence, and (3) the mills take large wire reels. The mills are operated at speeds from 500 to 1500 ft. per minute, depending on wire size (maximum design speed of the mills is 3500 ft. per minute). The company's experience in operating the mills has indicated the highest speeds at which particular wire sizes can be properly rolled.

* * *

One-stand flat wire mills inherently require a number of passes in rolling round wire to the fin-

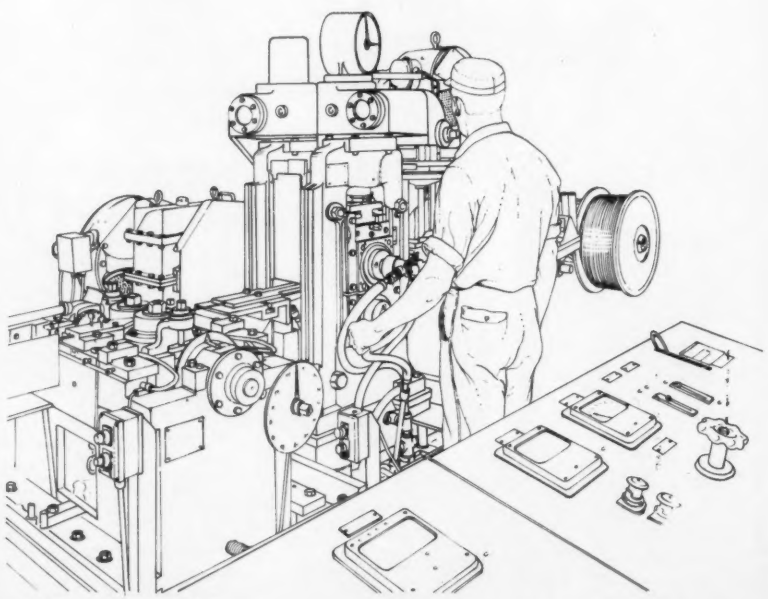

Figure 1

ished flat material. On the other hand, there is rarely any necessity for more than two passes on the three-stand mills, and most flat-wire sizes can be produced with one pass, minimizing the machine time for a given rolling order. In over six years of operation in this plant, the two flat wire mills have each produced orders in an average of five flat-wire sizes in an 8-hour shift.

* * *

The flat wire mills, as well as other production equipment in the plant, are built to take 4000-lb. supply and winding reels, rather than the smaller reel sizes that are more common in the industry. Production capacity is increased — and cost of machine time and labor per order reduced — by the resulting savings in set-up time. As a rough estimate, it takes 20 minutes for the initial set up for any wire size (described below) and 10 minutes for each additional set up on the same size run. Therefore, for a representative 3000-lb. run of flat wire, the 4000-lb. package requires 20 minutes in set-up time. With 1000-lb. reels, on the other hand, an additional 20 minutes after initial set up is required.

* * *

The labor cost with the two high-speed machines has been considerably lower than would have been required for the greater number of constant-speed machines producing the same output. Only one operator is needed to set-up and operate each mill and, with the help of hydraulic elevators, remove and replace wire.

Method of Operation

A high-speed flat wire mill includes a supply reel, wire straightener, first mill stand, first edging stand, second mill stand, second edging stand, third (or finishing) mill stand and winding reel on the output. Motorized or automatic screwdowns on the mill and edging stands are optional. The second edging stand, third mill stand and winding reels are shown, left to right, in Figure 1. The control console

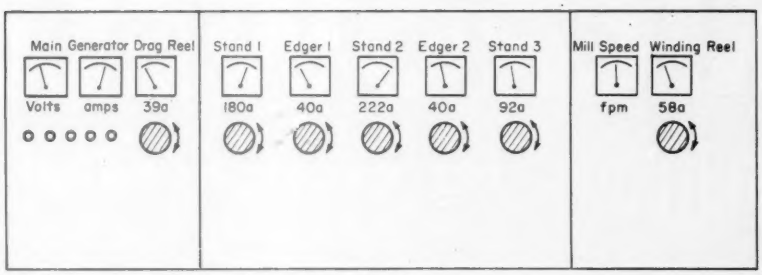

Figure 2

on the lower right in Figure 1 (depicted schematically in Figure 2) monitors all stages of the mill and is located for maximum convenience of the operator. Both of these flat wire mills were designed and built by The Torrington Manufacturing Company and are identical, except in the sizes of the rolls on the first and second mill stands. The machine which can accept the larger maximum size of starting round has 10-in.-dia. rolls on the first two mill stands and 8-1/4-in. rolls on the third finishing stand. The other mill has 8-1/4-in. rolls on all three mill stands.

* * *

Both mills are designed for a 50 per cent reduction of round wire on the first (breakdown) mill stand, 30 per cent on the second mill stand and a .005-in. reduction on the third (finish) mill stand. For example, .180x.750-in. flat wire would be rolled from .550-in.-dia. hard-drawn shaved copper wire in this sequence: down to .250 in. thick on the first mill stand, to .185 in. on the second stand and, finally, to .180 in. on the last stand. For further reduction in thickness, for example to .100 in., a second pass would reduce to .130 in. in the first stand, to .105 in. in the second stand, and then down to final size in the finish stand. Although the finish stands on these mills are capable of more, the wire manufacturer deliberately limits the reduction from .003 in. to .005 in. in order to maintain precise control of thickness.

Control of Mill Operation

There are two types of control which the operator must maintain during operation of the flat-wire mill. First, proper tension must be maintained in the wire between each mill stand, edging stand and reel. Tension control is maintained by the operator at the control console (Figure 2). Seven sets of ammeters and rheostats are provided on the console for the motor field windings on the drag reel, winding reel and five stands. The maximum allowable field current corresponding to the maximum tension permitted against each motor was determined early in the operation of the machines and marked, as shown in Figure 2, on each ammeter. The operator then continually reviews the ammeter readings and, when excessive current is indicated in a particular reel or stand, the corresponding rheostat is adjusted to reduce the wire tension. Of course, insufficient tension is indicated by slack in the wire, so that the operator then increases the field current.

* * *

Magnetic thickness and width gages between the finishing stand and winding reel continuously monitor the wire dimensions. These gages are connected to meters (between the finishing stand and operator in Figure 1) which indicate instantaneous deviation from the nominal specified dimensions. With motorized screwdowns on the edging and mill stands, as in Figure 1, any excessive deviation in width or thickness can be corrected by adjusting the roll spacing with pushbutton control. Usually in older flat-wire mills, the operator may instead correct drifts in width and thickness manually by adjusting crank levers. It is possible also to provide completely automatic dimensional control by connecting motorized screwdowns directly to the gages.

(*Please turn to page* 1593)

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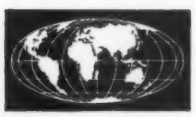
A.C.M.T.	.010" to .060" diameter alum.
E-1-C	.015" to .050" diameter
J-3-C	.031" to .064" diameter
J-4-C	.064" to .128" diameter
J-45-C	.080" to .204" diameter
J-5-C	.128" to .257" diameter
J-7-C	.187" to .375" diameter

FOR WELDING NON-FERROUS WIRE & RODS	
MODEL	CAPACITY
J-8-C	.250" to .500" diameter
J-5-ADU	.025"x3/8" to .035"x1/2" strip
J-6-ADU	.035"x1/2" to .035"x1 1/4" strip
E-C	.032" to .128" diameter
AD-3	.187" to .375" diameter
AD-4	.250" to .500" diameter
AD-5	.375" to .750" diameter



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for welding Copper, Copper Alloys and E. C. Aluminum wire in sizes from .080" to .500" diameter.

The Place of Polyethylene as a Wire and Cable Insulation

by J. C. Norton
Technical Center
Union Carbide Olefins Company
South Charleston, West Virginia

This paper was presented at the Annual Convention of The Wire Association on October 25, 1961, at French Lick, Indiana.

Mr. Norton joined the Union Carbide Olefins Company in 1934. His twenty-seven years with the company was interrupted only by a three-year stint with the Navy. He is a 1928 Electrical Engineering graduate of Notre Dame University. His experience has built up an excellent background on electrical insulation, including elevator wiring and industry consulting. Presently his responsibilities fundamentally are those of corporation consultant on matters pertaining to electrical engineering.

Introduction

The use of polyethylene as an insulation for wire and cable is continually expanding. Approximately seventy million pounds were used in 1957 and today the use has more than doubled. The rate of expansion is greater than other insulations and will further increase as case histories are made known. Industrial electrical engineers are becoming more familiar with the cable insulation requirements of power feeders and will be less influenced in the future by sales engineers' attempts to deliver "the good old standby" insulation. This discussion is based on experience gleaned from the use of polyethylene insulation for power cable in chemical plants located in Canada, California, the midwest, the east, and southern-most Texas.

Insulation Properties

The usual Physical-Mechanical and Electrical properties will not be discussed here as they are available thru handbooks and manufacturers' data. Some unusual properties and suggested testing for data are:

1. Physical-Mechanical

Polyethylene is the only proven satisfactory insulation for buried cathodic protection cable. It is highly resistant to DC currents, soil chemicals, and soil bacteria.

* * *

It is the only satisfactory jacket and insulation for use in the presence of DC voltages and metal ions which attack underground power feeders.

* * *

The Thermal Resistivity of polyethylene is approximately 70% of the thermal resistivity of rubber compounds. This is a plus factor for the dissipation of heat from the conductor.

* * *

Water absorption or permeability affects polyethylene less than any other non-metallic material.

* * *

Present methods of testing for water absorption wherein the sample is externally heated seem unrealistic and would apply only to deenergized cable in varying temperature baths. A more suitable method is that wherein the sample used is a short length of cable and the heat is obtained by energizing the copper conductor. Load is applied in progressive steps until failure of the insulation. It is doubtful that there would be sufficient laboratory time to obtain any data that would pin point "time-to-failure" for polyethylene.

* * *

Short and long time overload capacity of cable insulation is a factor that should be considered in the design of any industrial plant distribution system. Assuming that the 75°C cable is energized and the tripping time on a fault is approximately 10 cycles (which is slower than usual), the current that could be carried by a polyethylene insulated 500 MCM cable with a bolted fault is approximately 60,000 amperes, which means that some relay or the failure of some other piece of equipment will open the faulted circuit before the cable fails. Invariably it will be found that when overloading of any sort dictates a certain size of cable, a safer, larger size of cable is normally required because of needed operating ampere capacity and lower voltage drop. Unusual cases where ambient temperatures are very high and loading can be high during emergencies as in some utility network systems, it is necessary to use other types of insulation. The average electrical man is not aware of the heat represented by a 75°C normal operating cable. This is hotter than the average residential hot water system and is rarely encountered in operating cables.

* * *

Useful realistic data concerning overloads could be obtained by:

a. **Cable at operating voltage at 60 cycles.**
b. **Amperes load increased in 10% steps for 1 sec., 1 minute, 10 minutes, 30 minutes, and 60 minutes. Amperes, temperature, and time to failure at that level to be noted.**

* * *

Useful data concerning short circuits could be obtained by:

a. **Operating voltage at 60 cycles.**
b. **Amperes load increased in 25% steps for 5 cycles thru 60 cycles in 5 cycle steps until failure. Amperes, temperature, and time to failure at that level to be noted.**

2. Electrical

Basic factors, concerning electrical properties, utilized by the engineer are as follows:

a. **The** Dielectric Strength of

an insulation is the average electrical stress required to puncture a wall of the insulation of known thickness and is expressed in terms of volts per mil thickness. The highest number is the most desirable.

* * *

b. The Dielectric Constant is the ratio of the capacitance of a capacitor using this insulation as a dielectric to the capacitance of a capacitor using a vacuum as the dielectric. The lowest number is the most desirable.

* * *

c. The Dielectric Loss, in watts, is the product of the voltage, the charging current, and the power factor. This is directly proportional to the product of the dielectric constant and the power factor which is called the Loss Factor.

* * *

d. The Loss Factor is an indicator of the losses developed in a cable and is of particular interest in cable operating at 7500 volts and higher. A high loss factor would result in a lower capacity cable. Some typical Loss Factors are shown below:

Insulation	*Loss Factor*
90°C Rubber-Butyl	3.8 – 7.6
Oil Base	12.6 – 16.8
PVC	22.5 – 48.0
Silicone Rubber	1.5 – 9.0
Polyethylene	0.23

* * *

e. The Power Factor of a cable is the ratio of the dielectric loss to the total apparent power due to charging current. This is an indication of dielectric loss and a low number is desirable.

* * *

f. Insulation Resistance is the d-c insulation resistance in megohms per 1000 feet at 60°F. The higher number is desirable.

* * *

The above factors are well known and tables showing the relative merits of insulation are easily available from other sources.

* * *

A very important electrical property of high voltage cable is Corona Resistance. There have been papers presented in recent years concerning this subject which do not present correct conclusions regarding polyethylene as cable insulation. The tests incorporate a rod type electrode and a flat polyethylene sample laid on a flat plate electrode. The sample is subjected to 200 volts a-c per mil under varying physical stress conditions until breakdown. Pictures of the corona results produced on the sample are circular in shape and show the high density of the corona application due to the rod type electrode. This method of testing does approximate conditions found on a high voltage cable where the shielding tape has been punctured. A 15 kv shielded cable for grounded neutral service has an operating voltage to ground of 8.7 kv, assuming 15 kv at phase to phase. This cable has an insulation of 220 mils which means a voltage stress of 8700/220 = 40 volts per mil. All cable manufacturers know that when the shielding of a 15 kv cable is punctured, the cable life is short. The aforementioned tests prove that at 200 volts per mil stress with unusual corona concentration, the insulation will fail due to corona faster than at 40 volts per mil stress. This is an obvious conclusion without the testing. The chemical nature of the breakdown at 200 volts/mil might be of interest to a chemist developing a more corona resistant insulation, but is of little value to a cable user.

* * *

A suggested test for all insulations to show comparative corona resistance follows:

a. Sample insulation subjected to progressive 60 cycle voltage steps starting at the IPCEA test voltage level. Probably 10 minute intervals at each voltage level would be sufficient time. Results would show the voltage level and seconds to failure at that voltage level.

Existing Installations

The classes of cable covered herein are only the 3 kv to 5 kv shielded and non-shielded, and the 15 kv shielded installed by the Design and Construction Department of the Union Carbide Chemicals Company.

* * *

During the years 1944 through 1946 there were approximately 7000 feet of 3 kv non-shielded, non-jacketed cable installed. From early experimental installations came phrases like cold flow, environmental stress cracking, ultra violet breakdown, etc. Too many people would speak knowingly of polyethylene, using these and other similar phrases, assume the role of an expert, and cast many doubts into the minds of possible polyethylene cable customers. However, early in 1946, a 3 kv feeder carrying 2400 volts was installed underwater in a river back channel which was subjected to many types of chemicals being dumped therein. This feeder was removed in 1959 because of a new substation location and was replaced by a pair of 5 kv shielded and jacketed feeders. There had been no outages in thirteen (13) years with the original feeder and this installation did prove the chemical and water resistance of polyethylene.

* * *

From 1948 to the present time, approximately 570,000 feet of 5 kv, non-shielded, jacketed cable were installed. The operating voltags for this cable were 2400 volts and 4160 volts. There have been no outages except a few cables being cut by trenching and air drill machines.

* * *

Since 1957, approximately 61,000 feet of 5 kv, shielded and jacketed cable has been installed. The operating voltage is 4160 volts for wet, underground or underwater locations. There have been no outages in this cable.

* * *

1950 was the start of 15 kv, shielded and jacketed, cable installations. Until 1957 the jacket was PVC, but since has been polyethylene almost exclusively. There have been three or four failures with this cable due to external trouble. In one case a man drilled into the cable with an air drill without harm to himself. In the other cases, inexcusably bad installation procedure ruptured the shielding tape and the cable failed, after several years, because of corona cutting. The operating voltage on all of the 15 kv cable is 13.8 kv and approximately 410,000 feet have been installed in all kinds of environments.

The above case histories of over a million feet of 5 kv and 15 kv cable prove perfect performance for polyethylene as an insulation. There were no failures due to stress cracking, heat cracking, water absorption, or any of the usual insulation deficiencies.

Future Installations

The preceding case histories of polyethylene insulated cable show an obvious economic gain due to:

1. Lower initial cost than other cable.
2. No outages — thus no loss in production.
3. No cost due to replacement of cable or repairs to the original installation.

These case histories also form the foundation of experience needed to effect further economies, as:

1. Distribution System Design

Distribution System design for a chemical plant must encompass all economies possible and provide safety for personnel and equipment, with the least amount of production loss due to failures. Past practice has been to supply all process units through multiple feeders, or some form of primary or secondary selective systems. These are more expensive than the simple radial system of one breaker through one set of feeders. There is now no need for the possibility of cable failure to be a large factor in designing a distribution system and the cost of the system can be materially reduced by the use of single radial feeders.

2. Duct and Cable Pits

For underground power distribution, concrete enclosed duct systems and concrete cable vaults and pits are normally used. Due to the prohibitive cost of later additions to duct systems and cable pits, spare spaces for cable replacement and new feeders are alloted in the original installation. The best engineered systems always have spaces never used in some areas and not enough spaces initially included in other areas. These systems are quite expensive and in view of the past polyethylene insulated cable record, a new line of approach is indicated for underground systems.

* * *

The standard polyethylene insulated power cable has all requirements necessary for direct burial cable. When duct, or conduit, is not used, cable spacing and a reasonable amount of protection from external sources is needed. The following system includes these facts and the major part of the work can be accomplished by unskilled labor.

* * *

a. The cable system in most cases could consist of a machine dug trench, three inches of sand for bottoming, and corrugated transite or PVC laid for cable spacing and top protection. A covering of 3″ of sand over the top cable section and then back filling with the removed dirt would complete the work.

* * *

b. Cable pits to supplement this type of cable system would not need to be the usual reinforced concrete pit with heavy wall sections, manholes, and water proofing. The cable pit for this type of system need be only thin walled, shallow and light weight. After the cable and splicing work is completed, the pit is filled with sand which eliminates the need for heavily reinforced concrete walls. Suggested pit construction would be ¾″-1″ transite, molded plastic, fibre glass, or wire reinforced precast concrete. Since the probability of cable failure is very low, the entire pit can be below grade level and need be uncovered only when new feeders are needed. Cable entrance to the pit would be from a slot running from the top of the sidewall down to the cable location. This would preclude cutting cables at pits during the cable lay-in process.

* * *

Cable for the aforementioned system would be a three conductor, or three one conductors lashed by the manufacturer. Since the cable can be laid in the trenches and also the pits, the only limit to the length of lay-in cable would be the usable reel size. This also would save considerable labor cost over present methods of cutting and pulling cable.

* * *

The above noted type of underground power distribution system could not be fully utilized in all plants as some congested areas would require the standard type of concrete enclosed ducts and heavy wall cable vaults. However, utilization of the new system, wherever possible, would effect considerable savings in underground power distribution construction. Records of past installations show that only a small percentage of existing cable pits and duct systems are ever altered for new feeders.

* * *

To summarize, the economies possible due to the excellent performance record of polyethylene cable are:

1. True cost of a cable is the cost of power delivered, or cost per ampere per thousand foot of cable. This cost for an 85°C corona resistant butyl insulated, neoprene jacketed, 500 MCM, 15 kv shielded cable is approximately
   $\frac{\$2600}{325}$ amp = $8.00 per ampere per thousand feet single conductor
   The cost of a 75°C polyethylene insulated and jacketed 500 MCM, 15 kv shielded cable is approximately
   $\frac{\$1975}{300}$ = $6.60 per ampere per thousand feet single conductor
   Amperes load is based on 3 conductors per duct in a 6 duct bank, 100% loaded.
   To the savings in cable cost are added the other savings due to less failures thus less loss of production, less maintenance cost for replacements, and less cable used because of simple radial system feeders.
2. Utilization of the suggested underground distribution system could approximate 30% less cost than the concrete enclosed ducts and concrete cable vaults and pits system.

Future Developments

Research engineers are presently working on increasing the corona resistance and high temperature limitations of polyethylene. This work is progressing and polyethylene has a very promising future.

* * *

Semi-conducting polyethylene, now becoming available, is a forward step in the development of polyethylene insulated cable. The use of the semi-conducting polyethylene as a strand and insulation shield should allow the man-

(*Please turn to page* 1600)

What's Behind the Underwriters' Laboratories Requirements for Insulated Wires and Cables

by H. E. Collins
Service Engineer to
Wire and Cable Industry
Label Service Department
Underwriters' Laboratories, Inc.
New York, New York

When I was invited to talk at the Electric Wire and Cable Technical Session of The Wire Association's annual convention on "What's Behind Underwriters' Laboratories Requirements for Insulated Wire and Cable," I gladly accepted for two reasons. First, the Wire and Cable Industry is one of the oldest and most consistent supporters of Underwriters' Laboratories. And second, my work with Underwriters' Laboratories has kept me in very close contact with the Wire and Cable Industry for the last 15 years. As a result, the subject has considerable personal appeal.

* * *

Because the subject is a dynamic one, I feel it would be ill advised to spend too much time on a detailed discussion of specific requirements. Instead, I have chosen to discuss how, and for what purpose the requirements are developed. With such information as a background, it is easier to understand the need for certain requirements which otherwise might appear arbitrary and unjustified.

* * *

As most of you probably know, Underwriters' Laboratories is a non-profit organization sponsored by the stock fire insurance companies for the sole purpose of conducting tests in the interest of public safety. Since 1917 it has been entirely self-supporting through fees charged for its services.

* * *

To accomplish its purpose, the Laboratories must cooperate with manufacturers and inspection authorities, attempting to reconcile differences, so that there will be an uninterrupted flow of safe equipment to the public. While this is simply stated, it is not quite so easily effected. Under our system of government there is no central Federal authority that regulates or dictates safety requirements for electrical equipment or the use of such equipment. Local political districts, some of them municipalities, some of them counties, and some of them states, are charged with the safeguarding of their citizens and their laws are not subject to Federal review unless they raise a constitutional question.

H. E. Collins

This paper was presented at the Annual Convention of The Wire Association on October 24, 1961, at French Lick Indiana. **The author is a 1944 graduate of Pratt Institute with a BEE degree. From 1944 to 1946 he was with the Signal Corps of the U. S. Army. He joined U.L. in 1947 and in 1950 secured an MS degree from the New York State College for Teachers. Returning to U.L. in 1951, he became a Wire and Cable Section Assistant Electrical Engineer. In 1953 he was made Division Engineer and Executive Engineer in the same section. In 1958 he became a Standards Engineer in the Standards Department in charge of all U. L. Electrical Standards. He was promoted to his present post in 1960.**

* * *

It can be seen that this immediately raises a problem of diverse requirements with their stultifying effect on both the production and sale of the materials affected. The electrical industry has, through its sponsorship of Underwriters' Laboratories' listings, achieved a degree of acceptance throughout the country that transcends political and geographical lines.

* * *

As far as the Wire and Cable Industry is concerned, this sponsorship began almost 50 years ago. Prior to 1912, the wire and cable manufacturers operated a "self-certification" program through a semi-independent testing group known as the Wire Inspection Bureau, and controlled by a Board of Directors from the Wire Industry. Although Underwriters' Laboratories, Inc. started its own wire and cable inspection service in 1906, only small quantities of wire were labeled, and at least to a limited extent, our test facilities were used to conduct tests for the Wire Inspection Bureau. Around 1912, the Federal Government instituted anti-trust suits against all the member manufacturers, and the bureau was dissolved.

* * *

Shortly thereafter, the wire manufacturers came to the Laboratories and asked for conditions under which we would operate a factory inspection and labeling program. Suitable arrangements were made and, with few modifications, the program has functioned satisfactorily for the past 48 years.

* * *

Since 1912, the Laboratories'

part in the wire and cable business has grown appreciably. Initially the program covered only a few types of rubber-covered building wire, flexible cord, and fixture wire. Today the program covers more than a dozen main classifications of wire, cord and cable within which more than 1000 different types are listed or labeled. For further comparison, in 1912 the Laboratories labeled approximately one-half billion feet of insulated wire, cord and cable. In 1960, we labeled close to 20 billion feet, or enough to circle the earth approximately 150 times.

* * *

To establish and maintain requirements for so many types of wire is quite a job. Obviously it requires a knowledge of both the materials which go into the make-up of the wire and the end use of the wire. Underwriters' Laboratories does not profess to have all the necessary knowledge, but relies heavily on the assistance of manufacturers and inspection authorities.

* * *

Because all of the wire listed and/or labeled by the Laboratories is either for use in accordance with the National Electrical Code, or for use within appliances listed by the Laboratories, knowledge of the end use is easily acquired. Once the end use is known, many of the general requirements for wire intended for that use become apparent. For example, a wire intended for use in wet locations obviously must be moisture resistant. But how much moisture resistant, and for how long. And, how do you measure it. These are the areas in which differences of opinion arise.

* * *

Underwriters' Laboratories, with fifty years of experience testing and inspecting wire for safety has opinions. The wire manufacturer with his knowledge of wire design and manufacture has opinions. The inspection authority with his knowledge of installation and field experience has opinions. And last, raw material suppliers, with knowledge of their own materials, have opinions.

Collecting and resolving these opinions is not always an easy job, but it is one that the Laboratories must do continuously. Whenever a new wire comes along, or a new material is used in the make-up of an existing wire, or field experience indicates the need, new and/or revised requirements must be established. The procedure for doing this is very well defined.

* * *

As a first step, an outline of proposed requirements is prepared by the Laboratories staff. The proposals are based on experience and knowledge gained in the past, but with full recognition of the need for modification where new materials or designs are involved.

* * *

The outline is then discussed with the appropriate Industry Advisory Conference or Technical Advisory Panel, either through correspondence, or when warranted, in a meeting. The Conferences and Panels are composed of representatives from that segment of the wire industry affected by the proposals, and members of the Laboratories staff concerned with the investigation and inspection of wire. Industry representatives are selected for their familiarity with their division of the industry and reputation for sound judgment. They are considered to represent the industry rather than one manufacturer or trade association. They are expected to bring to the Conference a broad industry viewpoint, so that requirements and proposed changes of requirements will avoid the impractical.

* * *

Recommendations of the Conferences and Panels are carefully evaluated, and where indicated suitable revisions are made in the outline. Where revisions are extensive, further discussion is sometimes necessary.

* * *

The resulting outline then is forwarded to every affected subscriber to our inspection service, with notification that it has been reviewed and discussed with the appropriate Conference or Panel, and with a request for comments. In addition, it is forwarded to the Laboratories' Electrical Council, a group composed of electrical inspection authorities throughout the United States, selected for their experience and their judgment with a similar request for comments. And finally, it is sent to many other individuals, companies, and associations known to have an interest, or who have expressed an interest, in the requirements for wire. Here again comments are solicited.

* * *

As with comments received from the Conferences and Panels, all comments received from subscribers, Council members, and other interested parties are carefully reviewed and further revisions made in the outline where the need is indicated. In some cases the process is repeated several times before all differences of opinion are resolved. Some are never resolved.

* * *

Throughout this whole process, the Laboratories approach must be centered on safety. The economics of manufacture must be kept in mind, of course, but only to the extent that is consistent with adequate safety.

* * *

Admittedly what I have said today is sketchy. However, I believe it gives a little idea of what goes into the formulation of wire requirements of Underwriters' Laboratories. If any of you have any questions either on what I have said, or on some other phase of the Laboratories' operations, I will be pleased to answer them, or admit that I can't.

To members of the Wire Association an information service is available by which they can obtain data on any subject relating to the industry on which they desire information.

THE WIRE ASSOCIATION

Some Aspects of the Compatibility of Various Electrical Insulating Materials

by John E. Sloat
Production Manager
Hygrade-Flexite Division
L. Frank Markel & Sons
Norristown, Pennsylvania

This paper was presented at the Annual Convention of The Wire Association on October 24, 1961, at French Lick, Indiana.

An interesting observation on the American industrial society is that we seem to plan for a definite life in the devices and machines we produce. Accordingly, an average consumer expects his car, his refrigerator and the other things that he needs to feed, house, clothe and transport himself, to wear out. When they do wear out or become obsolete, it is accepted by him with reasonably good grace.

* * *

If this same average consumer were asked when he expected to replace all the insulated conductors and cables that serve him, his answer would most likely be that this possibility had never occurred to him because he had never expected them to fail.

* * *

Based on past performance, this reaction is a very normal one. The wire and cable industry has done an excellent job over the years of providing near perfection in product reliability and longevity in spite of misapplication, physical abuse and severe electrical overloading.

* * *

This record, we feel, is the result of a number of factors, among which is the hard work done by specifying agencies, the essentially internal regulating bodies such as Underwriters' Laboratories, who have given the industry basic performance minimums and enforcement of these minimums, without stifling the will to produce an adequate product for less cost to the ultimate user.

* * *

John E. Sloat

There are two other factors (and perhaps the most significant ones) that we believe have contributed to this good industry performance record, and they are these: first, the general external environment in which wire and cables operate has changed little over the years. The effects of sunlight, the ozone level in the atmosphere, the moisture content of the atmosphere, the extremes of temperature are probably not too much different today than they were fifty years ago.

* * *

All of this means that the cable designer has had many years of reliable field performance to draw on when he has been called on to design a cable to operate within the framework of this general environment.

* * *

The other very significant factor is that the great weight of wire and cable insulating materials, in our opinion, has changed relatively little over the years. The introduction of chlorinated rubber, the development of styrene-butadiene rubbers, the first use of vinyls and the successful application of polyethylene took place over the span of the last thirty years. Some of you lived through all of these changes and in retrospect, perhaps you will agree that some of the early failures of these good materials could have been avoided.

* * *

The point of this is that the wire and cable designer has had a relatively few basic new materials to become acquainted with and a relatively long time to put them through their development stages.

* * *

We, here at Markel's, with forty years of electrical insulating experience and techniques behind us, expect that in the next few years the major part of our insulating media are going to be materials that we only knew as words five years ago. The number of basic materials that an insulating engineer has available has increased, seemingly logarithmically, in the past few years. In addition to this increase in basic number, we must add the number that the insulator or wire manufacturer can make himself by completing chemical reactions in his own plant.

* * *

Most of these new materials are good ones, and in some cases less expensive than the old standbys. This condition subjects the insulation technician to one substantial pressure, that typically American one — make it for less so that we can sell

more, and make it better.

* * *

There is another pressure to which he is being subjected. We all know that war tremendously accelerates industrial technology and those of us who worked in this industry during the late, great war well remember that the impossible became almost the "order of the day". Probably all of us realize that we are in a war now, and perhaps a more deadly one because it is bloodless. In this war the cable designer does all the work on a prototype, gets most of the difficulties out of it and then is asked to make a better, different one without the breathing space and experience of cranking out millions of feet of a frozen design.

* * *

So, the problem is that since we have many more insulating materials, in closer proximity to each other than ever before and usually operating at higher temperatures, what effect will they have on each other at their operating temperatures? Further, mechanical components are no longer just the old, accepted materials but have been augmented by the addition of newer plastics. The application engineer may not be able to avoid the possibility of longtime service failure as well as he did in the past. In short, will the wide range of materials that could be used in a cable or in a device at a cable termination, be compatible with each other, or will they, over an extended life, be self-destructive? And if so, certainly detracting from the good record of the industry.

* * *

At Markel's we have been working at developing a reasonably reliable shorttime compatibility test to predict how a given material will react with others in a simulated life test. Feeling that in a dielectric material, the most important characteristic is dielectric strength, we decided for a beginning at least, to use dielectric strength as the measure of deterioration of a given dielectric material.

* * *

Bearing in mind some of the weird results from oxygen bomb tests, where substantially different rubbers were aged in the same bomb and also mindful of the strong effects vinyl slabs had on each other when heat aged in close proximity in the same oven, we felt a compatibility test could be patterned after these. We further concluded that, since most of the applications with which we are concerned are vented, we should use a covered but not tightly sealed test chamber.

* * *

Since a substantial part of the products we make are used in conjunction with magnet wire, we used these materials in our first round of tests. Following is the test procedure we used:

* * *

Clean, heat resistant test tubes 25 mm x 200 mm were placed in a static air oven at the listed operating temperature of the respective materials. While the test tubes heat-soaked for one hour, the samples were prepared. This was done by twinning like strands of magnet wire as described in Military Specification JAN-W-583 dated 7 April 1948, Section F-4C. The twinned samples were cut to 6" ±½" long. The insulating material samples used were cut 6" ±½" long. After the test tubes were heat-soaked, seven twinned pairs of one type wire and one piece of like rated insulating tubing were placed in each of the tubes and the heating continued for one more hour. Then the open ends of the tubes were closely covered with a double thickness of aluminum foil and allowed to remain in the oven for fourteen days. At the end of this time the tubes were removed from the oven and allowed to cool to room temperature with their covers on.

* * *

After the tubes and their contents had reached room temperature, dielectric breakdowns were run between the legs of the twisted pairs. The lowest value of the seven was discarded and the average of the remaining six was posted as the value for that test. We used the control in

(*Please turn to page* 1604)

TABLE I

COMPATIBILITY TESTS

CLASS "B" COATINGS

Dielectric Breakdown (Avg. of 6 Twisted Pairs)
After 14 days at 155°C. in a Covered Tube

Insulating Tubing	Magnet Wire Tested			
	Polyamide	Acrylic	Polyvinyl Formal	Terephthalic Polyester
Control (no sample)	5.10	7.36	3.84	11.45
Plasticized Vinyl on Glass	1.62	4.24	2.00	9.85
Isophthalic Polyester on Glass	4.02	7.72	4.44	11.40
Acrylic #1 on Glass	0.94	8.36	No test	10.52
Acrylic #2 on Glass	5.92	6.05	No test	9.56
Acrylic #3 on Glass	0.92	8.44	No test	10.84

TABLE II

COMPATIBILITY TESTS

CLASS "F" COATINGS

Dielectric Breakdown (Avg. of 6 Twisted Pairs)
After 14 days at 180°C. in a Covered Tube (Kilovolts)

Insulating Tubing	Magnet Wire Tested				
	Epoxy	Polyurethane	Crosslinked Terephthalic Cyanurate Polyester / Linear Terephthalic PE Outer Coat	Terephthalic Polyester	Cyanurate Terephthalic Polyester
Control (no sample)	5.32	2.52	10.03	8.24	8.84
Polyurethane on Glass	6.30	1.48	10.16	10.52	9.04
Polyurethane on Glass	6.68	1.16	10.16	6.92	8.40
Acrylic #1 on Glass	2.65	1.32	10.76	8.95	9.76
Acrylic #2 on Glass	1.50	0.52	10.60	10.24	7.92

Unusual Photocell Loop Control System for Wire Rod Mill

Description of a new rod mill and a new method of controlling looping, especially important for short runs of stainless steel.

One of the most progressive wire rod mills in Europe is the Aosta Works of **Nazionale Cogne S.A.**, Torino, Italy. This firm, a long established steel producing firm, has been operating a new, modern mill since 1960, when the old rod mill was discontinued. The new rolling mill was planned for production of rods of quality steel for use in wire ropes, ball bearings, springs, tools, etc., (Fig. 1) shows a simplified plan of the new mill.

Planning

When planning the new mill, the following points were taken into consideration:

* * *

1) **The** billets produced by the company's own blooming mill have a square section of 4.8 x 4.8 inches (120 x 120 mm) which means that the rolling mill has to make a total reduction 30 per cent greater than that regarded as normal for this type of rolling mill.

* * *

2) **The** highest demands were to be made on the tolerances and surface of the rolled rod.

3) **The** mill had to be built for a widely differentiated rolling programme, that is to say, it was to be possible to roll steels of the most varying qualities.

4) **Because** production would mainly be in short runs, the mill had to be planned so that the change-over from one production program to another could be carried out in the shortest possible time.

* * *

To fulfill the second condition, stretching of the rod had to be avoided. This meant that loops would have to be formed between one stand and the next and that only one rod could be rolled at a time. Thus, in order to achieve a satisfactory rate of production, heavy coils and high outgoing rod speeds would be required.

* * *

Particularly, when rolling stainless steel, the cooling of the rod has to be avoided. This material can only be worked within a very small temperature range, which means that the difference in temperature between the beginning and the end of the rod must be strictly limited. To reduce cooling, the loops must be short, and this applies especially to the loops in the rod mill since, because of its small diameter, the rod cools very rapidly.

* * *

The demand for short change-over times when switching from one program to another necessitates relatively advanced automatic control, primarily of the motor speeds. Messrs. Luigi Pomini, Castellanza, have supplied the mechanical rolling mill equipment for the new plant, and ASEA of Asteras, Sweden, have supplied the electrical part. The main motors and the transformers were manufactured by the ASEA licencee in Italy, Societa Nazionale delle Officine di Savigliano, Turin.

* * *

Fig. 2 shows a general view of the rolling mill. The heating furnaces for the billets and the roughing mill can be seen in the foreground, while the intermediate, looping and rod mills, as well as the cooling bed, can be seen in the background.

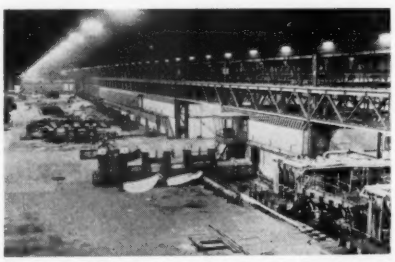

Fig. 2 — General view of rod mill. Courtesy of S. A. Luigi Pomini. * * * * * *

The roughing mill consists of three stands driven by a common motor. The tilting table and the roller tables in the roughing mill can be operated either manually or

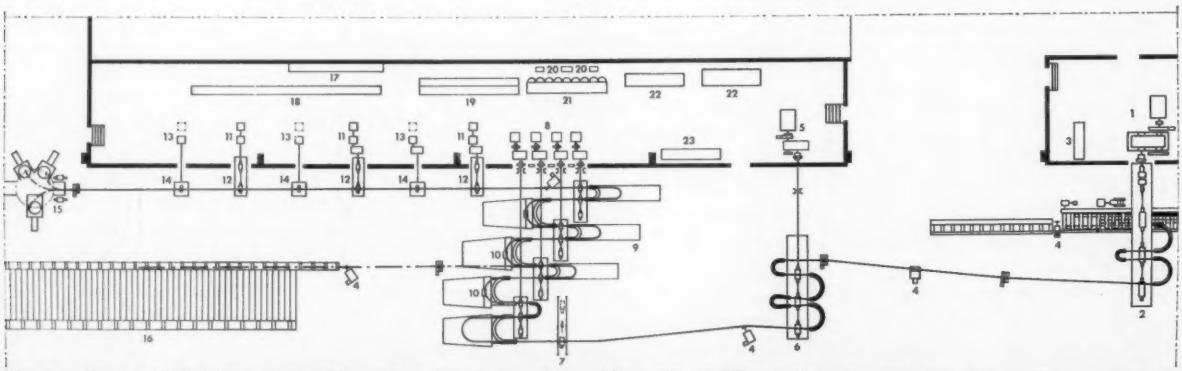

Fig. 1 — Layout of Rod Mill. 1) Roughing mill motor; 2) 3-stand roughing mill; 3) Slip regulator for roughing mill; 4) Shears; 5) Motor, intermediate mill; 6) 3-stand intermediate mill; 7) Pinch rolls; 8) Motors for looping mill; 9) 4-stand looping mill; 10) Loop regulators; 11) Motors for stands 1-4, continuous mill; 12) Horizontal stands, continuous mill; 13) Motors for stands 5-6, continuous mill; 14) Vertical stands, continuous mill; 15) Coilers; 16) Cooling bed; 17) Switchgear; 18) Main control panel; 19) D. C. Switchboard; 20) Anode reactors; 21) Rectifier cubicles; 22) H. V. Switchgear; 23) 380V control board. * * * * * * * * * * * * * * * * * *

entirely automatically. In the case of automatic operation, photocells transmit information as to the position of the bar to a relay station from which the various movements are controlled. The transverse movement of the bar is arranged by means of a number of guides.

* * *

The intermediate mill consists of three two-high stands with common driving machinery. Between the stands there are loop tables and repeaters. The looping mill (Fig. 3) consists of four separately driven, alternating two-high stands with horizontal loops between the stands. The roll stands

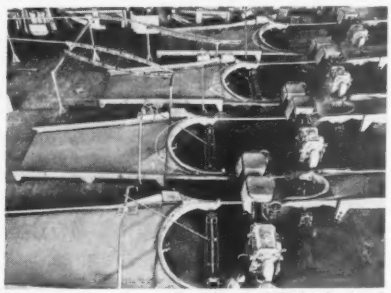

Fig. 3 — Looping mill with 3 ASEA electronic regulators. Courtesy of Nazionale Cogne S. A.

in the looping mill and in the rod mill are of pre-stressed type. Of the eight loops in the looping mill, three are electrically regulated. As can be seen from the illustration, the loop regulators are located above the loop tables and indicate the position of the loops photo-electrically without any mechanical contact with the bar. The information from the loop regulators controls the speed of the motors so that virtually constant loop lengths can be maintained throughout the rolling operation.

* * *

To obtain rod in lengths, the output from the looping mill can be taken directly to the cooling bed, which is of conventional type. If coils are required, the rod can be coiled in the coilers placed after the continuous wire rod mill. If smaller sections are desired, the rod can be directed from the looping mill to the continuous mill where further reduction takes place. The continuous rod mill has a design which is somewhat different from that usual for rod mills for special steels. The roll stands have been arranged in a straight line with the loops hanging freely between the stands (Fig. 4).

Fig. 4 — A hanging loop. ASEA loop regulator in background.

* * * * * * *

In rolling mills where one motor drives two stands, the increase in loop size must be regulated by means of mechanical calibration, which means that, to some extent, the demands for close tolerances must be dispensed with. Nazionale Cogne has therefore selected the alternative making use of individually driven two-high stands in the rod mill. This arrangement also increases the flexibility of the mill and allows of a more rapid transition from one program to another.

* * *

The continuous rod mill consists of six stands, three horizontal and three vertical. The mechanical equipment used for guiding the rod is extremely simple. When the rod enters the mill, it is guided from one stand to the next in a closed channel, the bottom of which rapidly opens as soon as the rod has entered the next stand. The electric loop regulation adjusts the loop so that it remains at a constant length, of great importance, since it eliminates variations in the tensile stress to which the rod is subjected. Because of the accurate loop regulation and the very small amount of elasticity in the prestressed roll stands, the tolerances of the rod can be kept within very narrow limits. It may be worth noting that the variations in the diameter of the rod for a complete coil (1,250 m) are less than 0.04 mm.

* * *

The mechanical and electrical reliability of the rod mill has proved to be extremely satisfactory, which also can be said of the other parts of the mill.

* * *

From the rod mill, the rod passes through pinch rolls to the pouring coilers. The coils then are automatically lifted up from the coilers on to a conveyor belt and then on to a hook conveyor for cooling and transport to the storage area.

The Electrical Equipment

With the exception of the roughing mill, all the roll stands, coilers, shears and pinch rolls are driven by d.c. motors.

* * *

The roughing mill is driven by a 1,500 h.p. slip-ring induction motor. It is directly connected to a gear with two flywheels mounted on the high-speed shaft. The secondary resistor of the induction motor is of contactor type, automatically regulated in accordance with the adjustable maximum motor current. By this means, unnecessary load peaks on the supply network, arising from the brief, but heavy, passes in the first stand, are avoided.

* * *

All the other rolling-mill motors and the motors for the pinch rolls and the shears are fed from three rectifier groups. Each group consists of one rectifier transformer and three 6-anode mercury-arc rectifiers. Normally, rectifier group 1 feeds the intermediate mill, group 2 the motors in the looping mill and the motors for the shears and pinch rolls, while group 3 feeds all motors in the continuous rod mill.

* * *

The three rectifier groups are electrically separate and thus cannot work in parallel. However, the busbar system is so designed that the different motor groups can be fed from any of the rectifier groups, which means that service can be maintained to a limited extent even if one rectifier group should fail.

* * *

The rectifier transformers, which have a primary voltage of 5 KV and a maximum secondary voltage

of 600 V, are provided with on-load tap changers which permit the secondary voltage to be varied in 19 steps from 600 V to 415 V and reconnection down to a minimum of 240 V.

* * *

The voltage variations on the internal 5 KV network are sometimes rather large since six arc furnaces are connected to it. To avoid disturbances on the d.c. network, with resultant interference in the speed regulation, the voltage of the rectifiers is regulated by means of grid control. When starting the motors, the rectifier voltage is reduced to 6 V and then starting is smoothly carried out by linearly increasing the voltage up to the set transformer voltage.

* * *

In rolling mills for the production of high-quality steel, the very highest demands are made on the rapidity and accuracy of the speed regulation. The rod must pass through the entire rolling mill without being stretched, necessitating the formation of short loops between one stand and the next to avoid excessive cooling. Particularly in the continuous rod mill where the speed of the rod in the last stand is more than 70 km/h (4,000 ft./min.) and where the loop length must be regulated with an accuracy of ±10 cm (4 in.), accurate speed regulation is indispensable. As an example, it may be mentioned that a speed error of 1 per cent reduces a loop from the normal length of 40 cm (16 in.) to 0 cm, in less than two seconds, with consequent stretching of the rod. It may therefore be of interest to describe how regulation takes place. Fig. 5a, b, c shows a simplified diagram of the regulation circuit. As previously mentioned, the rectifier voltage can be varied within the range 240-600 V. The most suitable voltage level can be selected for each rolling program. The speed of the individual motors is then controlled by means of field regulation.

* * *

The field winding of the motor is connected in series with a booster exciter, to a constant direct voltage, and variations in the field current are brought about by changing the excitation, and hence the

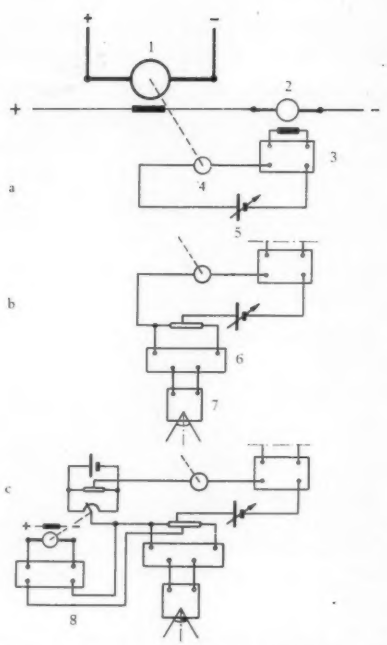

Fig. 5a, b & c — Simplified circuit diagram of ASEA loop regulators. 1) Main motor; 2) Impulse Exciter; 3) Transducer amplifier; 4) Taco generator; 5) Thyatron regulator; 6) Loop regulator. Courtesy of ASEA, Vasteras, Sweden.

output voltage of the booster exciter. The latter is controlled by push-pull-connected transductor amplifiers, the output voltage of which is determined by the current strength in the control winding. In the steady-state condition, the tachometer-generator voltage is opposed to, and virtually equal to, the reference voltage, resulting in zero control current.

* * *

If, for example, the motor speed falls while the reference voltage remains the same, the equilibrium in the control circuit is disturbed and a control current is obtained which affects the transductor and consequently the booster exciter in such a way that the motor field current is reduced, whereupon the motor speed increases and equilibrium is restored. The motor speed can be selected by varying the reference voltage. The individual speed regulation as outlined above keeps the motor speed virtually constant irrespective of variations in the load. However, the fact that the ratio between the outgoing speed of the rod from a stand and the peripheral speed of the rolls is not constant, but varies with the temperature of the rod, makes necessary the supplementing of the speed-regulation system.

* * *

The movement of the loop between two stands indicates how the individual speeds of the stands correspond to each other. By measuring the loop position, and by introducing the measured value into the control circuit, speed regulation is obtained which takes the above-mentioned variations into consideration.

* * *

The box of the sensing device which can be seen in Fig. 6, has a long narrow window which in this case is fitted with a funnel to eliminate extraneous radiation. It contains a photocell device, sensitive to infra-red radiation, that senses the position of the loop and produces an output voltage, the polarity and amplitude of which are proportional to the deviation of the loop from its normal position. The output from the photocell is amplified in a thyratron amplifier and introduced into the control circuit as shown in Fig. 5b.

* * *

All six motors in the continuous

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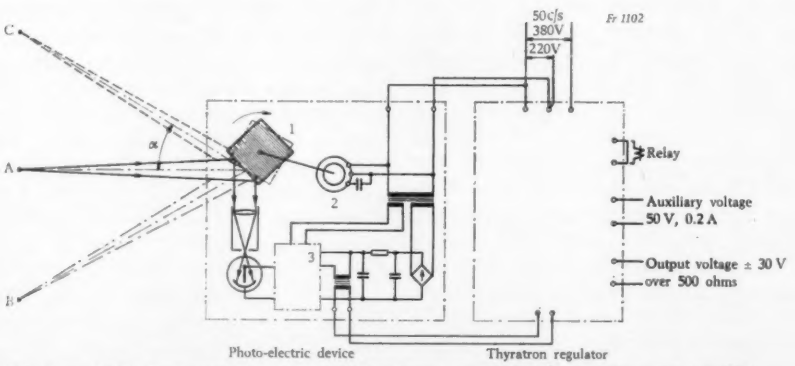

Fig. 6 — ASEA loop regulator. 1) Rotating mirror; 2) Synchronous motor; 3) Amplifier.

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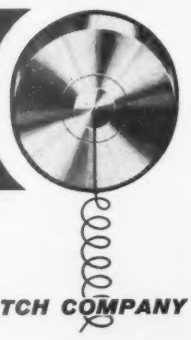

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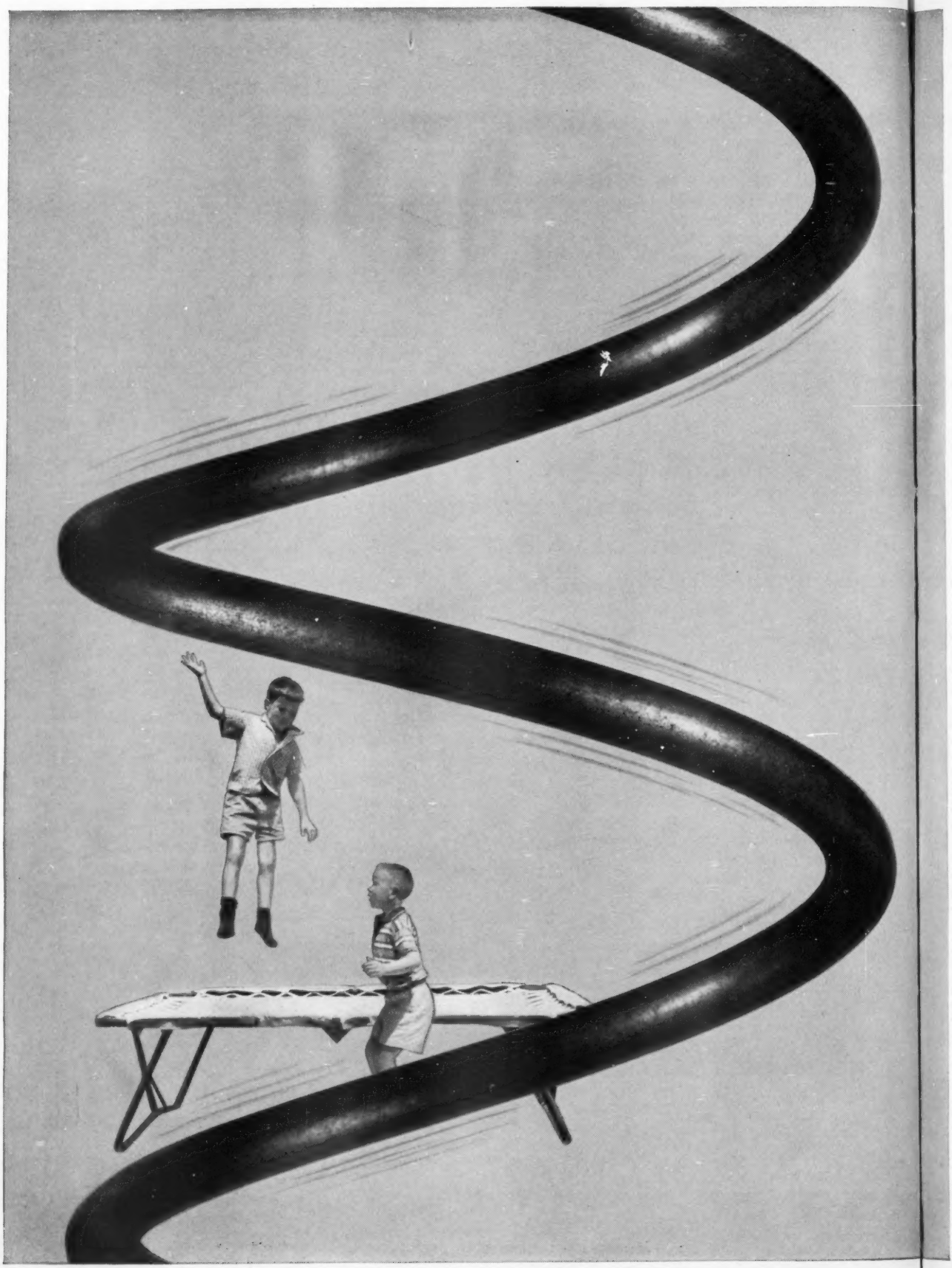

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The Cold Facts About the American Steel Industry

In the March issue of the CF&I Blast, A. F. Franz, President of the Colorado Fuel & Iron Corporation, wrote an article, "Imports are Hurting Your Jobs." In the September 18, 1961, issue he has followed this up with further comments and data, excerpts from which are reproduced here by permission.

American steel is troubled! Low-priced imports from foreign countries are choking markets for certain types of steel products and our exports are falling as an increasing number of modernized foreign steel producers woo and win buyers here. Mill product costs are spiraling upward at a dizzy pace and a new danger, price reductions, has appeared on the scene to compound the situation.

* * *

Competition from abroad is playing havoc with domestic sales and profits, particularly for "Little Steel." In June, 1961, imports of steel mill products rose to its highest point in 14 months, while exports were half of what they were in the same month last year. The following table shows what the relation between imports and exports was in the first half of this year.

Total U. S. Imports and Exports of CF&I-Type Products
For the First Six Months of 1961
(Net Tons)

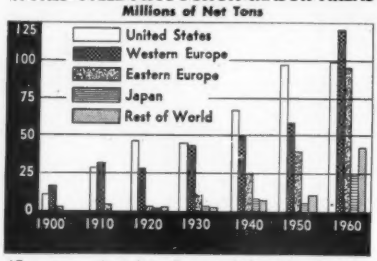
PRODUCTS	Imported to the U. S.	Exported from U. S.
Wire Rods	177,209	1,965
Concrete Reinforcing Bars	256,017	5,469
Hot Rolled Carbon Bars	47,427	20,330
Structural & Bar Shapes	200,497	111,923
Steel Pipe and Tubing	233,776	99,456
Wire Nails	110,656	1,697
Wire Fencing	15,262	882
Barbed Wire	43,242	418
Wire Rope and Strand	16,006	4,165
Round Wire and Steel Wire	82,099	3,498
Galvanized & Other Coated Wire	14,365	3,566
Pig Iron	69,773	204,981
Total	1,266,329	458,350

Our problems appear to be only beginning. Spokesmen for Europe's leading steel industries already are predicting that their combined output soon will equal that of the United States. The chart below provides the reason for grave concern. (See top of next column.)

* * *

Steel ingot production has increased abroad to the extent that whereas our production was 46% of that of the rest of the world in 1950, in 1960 it had fallen to 26%. During this period our exports declined from 15% of the world steel trade to only 7% while imports rose from 1 1/4% of domestic consumption to 5% last year.

WORLD STEEL PRODUCTION-MAJOR AREAS
Millions of Net Tons



(Source: *American Iron and Steel Institute*)

* * *

This leads to a consideration of profits. The American Iron and Steel Institute reports on the profits of the industry as follows, which are barely one-third of those of 1959.

Net Profits

Quarter	1959	1960	1961
1st	$318,416,351	$352,693,520	$ 80,393,790
2nd	466,116,753	205,362,004	190,586,663
6 mos.	$784,533,104	$558,055,524	$270,980,453

Besides the fact that some integrated companies have reduced dividend payments and others eliminated them, it also affects the income of our Federal Government. It should be noted some few companies have maintained their regular dividend payments, even though they did not earn them. The combined tax payments made by the wire producers of the U.S.A. is shown in the tabulation below.

Federal Income Tax Revenue

Quarter	1959	1960	1961
1st	$320,631,208	$360,001,074	$ 68,184,982
2nd	499,991,000	193,640,500	171,949,991
6 mos.	$820,622,208	$553,641,574	$240,134,973

Profits are down due to three factors: 1) Increased production costs, 2) Declining volume, and 3) Falling prices. The average price of finished steel, as measured by the U.S. Bureau of Labor Statistics Index of 100 for the 1947-49 period, was 185.4 on July 11, the lowest point since August, 1958. It stood at a peak of 187 in January 1959, from which point it dropped to 186.2 at the beginning of 1961.

* * *

Profit is the one great motivating force in our free enterprise system. It is the tonic and energizer of the American economic life-stream. It gives us national security and industrial muscle to resist aggression. It enables business to provide jobs, to expand and modernize production facilities, and to pay dividends to stockholders—and who shall say that these last are not entitled to a fair return for the use of their money?

* * *

Many American steel plants are antiquated and out of date. To the extent that they are, they are ham-strung by inefficiencies occasioned by lack of adequate profits. Another factor in the cost of modernizing is that our depreciation allowances are not reasonable.

* * *

Present allowances are wholly inadequate to cover the cost of new equipment. A recent Treasury Department survey indicated that depreciation allowances cov-

(*Please turn to page* 1605)

The Patenting Process in the Production of High Quality Patent Steel Wire

by Arthur Cooper, Esq.
Assistant Metallurgist
Rylands Brothers Limited
Warrington, England

A paper presented in the Staff School of the Caledonia Works of Frederick Smith & Co. Wire Manufacturers Ltd., Halifax, England, by whose kind permission it is published in Wire and Wire Products.

Mr. Cooper is a graduate of the Manchester College Science and Technology and a member of the Institute of Metallurgists. He joined Rylands Brothers in 1950 as a Laboratory Assistant.

It is well known that low carbon steel in the hot rolled condition is capable of being worked heavily by cold drawing, but with increasing carbon content it becomes more difficult. The maximum reduction possible decreases in proportion to the increase in Carbon content. Figure 1 illustrates the effect of Carbon content on the reductions possible from a hot rolled rod.

* * *

It will be appreciated that brittleness is associated with the state in which carbon is distributed through the iron. In a hot rolled rod which has cooled slowly from the rolling temperature the Carbon is in the form of a coarse lamellar pearlite. An example of this is given in Figure 2 which is a photomicrograph of a hot rolled 0.6% Carbon steel at a magnification of 1000X. The laminations observed in the microstructure are alternate plates of ferrite (iron) and iron carbide (cementite) — the latter, being the brittle constituent, resists cold work whereas the ferrite, being soft and ductile, is readily cold worked; in consequence, due to the different properties, uneven deformation occurs during drawing and the high internal stresses resulting from this lead to the formation of small internal cracks with eventual fracture of the wire.

* * *

The ratio of pearlite to ferrite increases with carbon content and at approximately 0.85% Carbon the microstructure is entirely pearlitic; steels approaching this composition are totally unsuitable for cold drawing, without heat treatment, due to extreme brittleness.

* * *

Greater ductility is obtained when the iron carbide is homogeneously distributed throughout the ferrite, this can be achieved by a spheroidising anneal at a temperature of 700/710° C., soaking for several hours. Figure 3 shows the resulting microstructure from this heat treatment. In this condition the steel is highly ductile but even with very heavy reductions it is impossible to develop high tensile strength in the finished wire. High tensile strength together with ductility can only be achieved with a much finer dispersion of the iron carbide.

* * *

Towards the latter end of the 19th Century many secret processes were being worked for the so called 'improving' of rods for the production of high tensile strength wire for ropes, springs, etc. Each wire manufacturer had his own method which had been developed by trial and error, for at that time there was little knowledge of metallurgy. One of the earl-

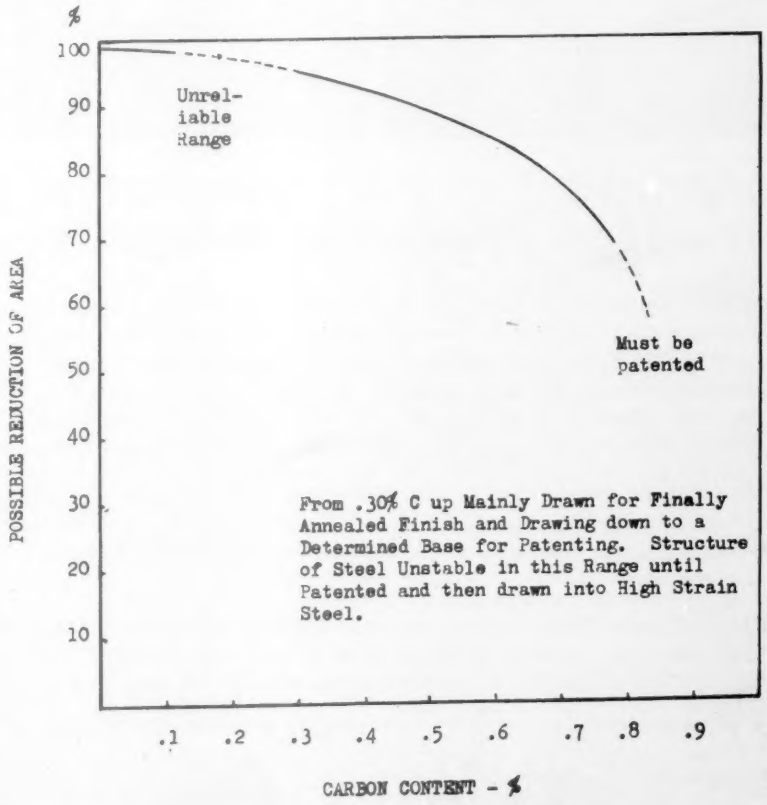


Figure 1 showing effect of Carbon Content on the reductions possible of a hot rolled rod.

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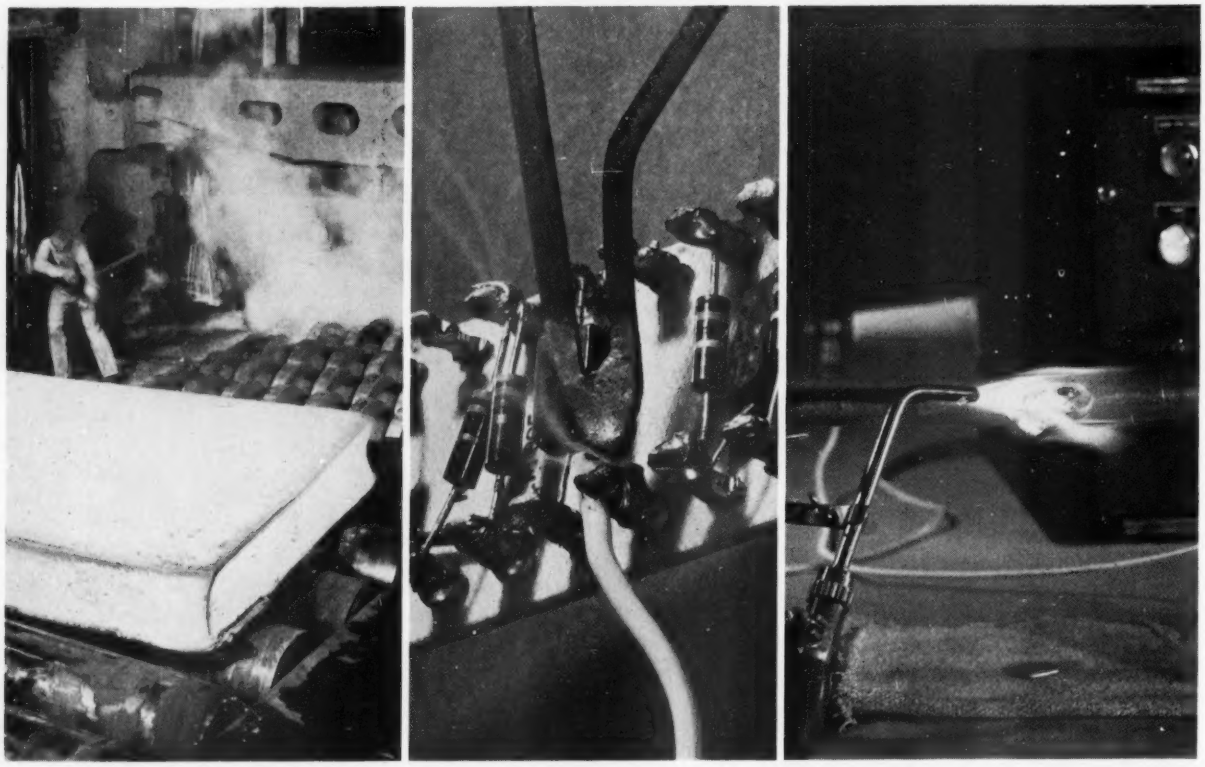

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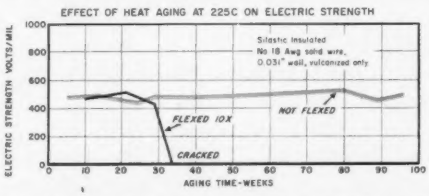

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Write Dow Corning Corporation, Midland, Michigan, Dept. A723 for detailed information and list of suppliers offering Silastic insulation on wire and cable.

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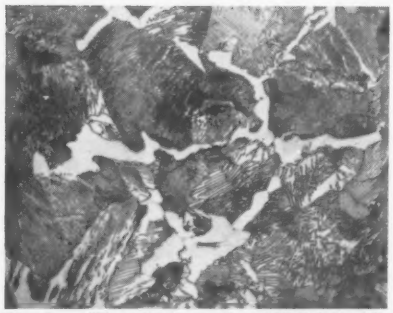


Fig. 2 — Microstructure of a 0.6%C hot roller rod, showing coarse lamellar pearlite and ferrite grain boundaries. X 1000

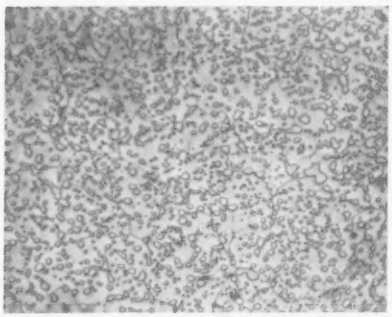


Fig. 3 — Speroidal cementite produced by prolonged heating at 700/710°C. X 1000

iest processes involved placing a coil of rod into a beehive furnace maintained at a high temperature; when the coil had attained furnace temperature one end was drawn out from the furnace along the shop floor, the rod cooling freely in the air. A refinement of the process replaced air cooling by a quench into a bath of molten lead or salt maintained at a temperature of approximately 500° C. It will be seen later how this temperature found by trial and error has been substantiated by experimental work done in more recent years.

* * *

Fundamentally the process of patenting has changed little from the early days. With the advent of automatic temperature control and a knowledge of the structural changes which take place, an accurate control over the process can be achieved and a uniform product obtained. Uniformity of the base material permits the standardisation of wiredrawing practice making possible the prediction of the properties of finished wire with accuracy.

* * *

There are two processes worked, namely air patenting and lead patenting, the actual equipment differing from place to place.

* * *

The basis of all heat treatment processes is the initial formation of austenite. When steel is heated to a temperature in excess of its upper critical temperature a homogeneous solid solution of Carbon in iron is formed, known as austenite. The temperature at which this transformation occurs depends on the Carbon content, ranging from 910° C., for pure iron down to 723° C., at approximately 0.85% Carbon. On very slow cooling, transformation of austenite takes place initially with the separation of ferrite at grain boundaries followed by the formation of coarse lamellar pearlite at 723° C.

* * *

However, an increase in the cooling rate, such as obtained by cooling freely in air, has a pronounced effect on the transformation. Much less ferrite separates at grain boundaries and the pearlite, although still lamellar, is much finer. The transformation of austenite proceeds by the diffusion of Carbon atoms and is time dependent; thus if the time available is restricted, diffusion over large distances cannot occur. A finer transformation product is formed, therefore, by diffusion through shorter distances. Very rapid cooling rates prevent diffusion altogether and no transformation of austenite takes place; however, austenite is unstable at low temperature and a brittle constituent — martensite — is formed.

* * *

In the air patenting process the steel is austenitised in the region of 1050/1100°C., and allowed to cool freely in air. Such high furnace temperatures are necessary to permit grain growth. The size of the austenite grain depends on temperature and time at temperature; just above the upper critical temperature it is very small but grain growth occurs as the temperature is increased. Grain growth occurs at lower temperatures but very long soaking time is necessary to develop a satisfactory grain size, therefore it is more economical to use high furnace temperatures with short soaking times.

* * *

However, for any given cast of

steel there is an inherent grain size which is the maximum attainable size; various factors influence this, aluminium having the greatest effect—aluminium killed steels have a very small inherent grain size. Grain boundaries act as nuclei for the precipitation of ferrite, so the smaller the grain size the more nuclei are present for the precipitation of ferrite due to there being more grain boundaries. A relatively large grain is generally preferred, the quench is more effective yielding better properties in the finished wire.

* * *

On the rate of cooling depends the resulting microstructure; the most satisfactory condition is one in which the entire pearlite and free ferrite of the hot rolled rod are absorbed into a homogeneous constituent known as sorbitic pearlite. Figure 4 is a photomicrograph of an air patented 5 gauge rod at a magnification of 1000 X.

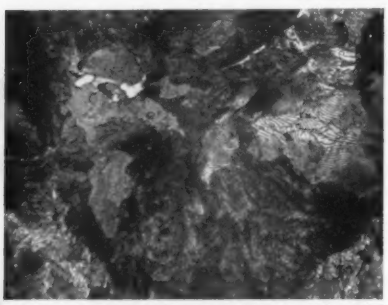


Fig. 4 — Microstructure of air patented 0.7%C, No. 5 S.W.G. rod. * * * * * *

If the cooling rate is too slow complete transformation will take place resulting in the separation of ferrite at grain boundaries together with the formation of coarse lamellar pearlite, this structure being similar to the original rod structure. On the other hand, should the cooling rate be too fast the transformation from austenite to sorbitic pearlite may be suppressed and a brittle condition result due to the formation of martensite.

* * *

As the cooling rate depends chiefly on the gauge of rod or wire being patented there must be a size above or below which the patented condition will fall short of the ideal. Fortunately there is some latitude before the ill-effects become apparent. However, when the size is outside the range that will give a satisfactory patented condition the heat treatment can be influenced to a certain extent by varying the Manganese content of the steel. For a thicker rod increasing the Manganese content gives the effect of increasing the cooling rate whereas for a small wire a lowering of the Manganese content has the effect of reducing the cooling rate.

* * *

It has been reported recently that a more effective quench can be obtained by passing the rods or wire through tubes and cooling by a controlled air blast. The process is said to afford better control over the structure. In the writer's experience nothing is to be gained—the disadvantages outweigh the advantages.

* * *

Air patenting is normally carried out in a gas fired muffle furnace, the products of combustion forming the furnace atmosphere which must be controlled to keep decarburisation to a minimum. Figure 5 shows a furnace used for air patenting which can also be used for lead patenting. Close control on the temperature is essential and is kept within $\pm 10°C$. The furnace has three or four zones, each with its own control; the rods or wire are heated uniformly and only attain the maximum temperature approximately 10 or 12 feet from the end of the furnace.

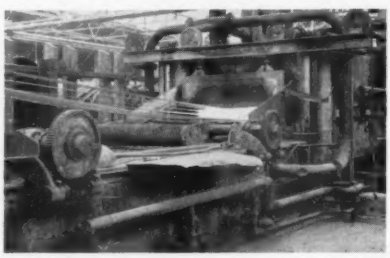


Fig. 5 — Air patenting furnace. * * *

Output depends on heatng capacity of the furnace, which for the furnace shown is two tons per hour with 32 runners. Running speed is governed by the rod or wire size.

* * *

In the plant of which this description is made the equipment has been standardised, both air and lead patenting is carried out using similar equipment. Air patenting is only used for drawing down to base sizes for subsequent lead patenting.

* * *

Coils of hot rolled rod or base wire are loaded on to a two section swift, the top section acts as a holder for the new coil while the bottom section carries the coil already running. Figure 6 is a photograph of the swifts. Coils are

Fig. 6 — View from swift end of furnace. *

joined together by electric butt welding; this is to be preferred to a hook and eye joint which can cause roping in the furnace. Roping is to be avoided for it is not possible for a group of rods running together in a bunch to attain furnace temperature and an unsatisfactory structure is obtained. When the bottom coil has run off, the new coil on the top section of the swift is dropped. The rods are led into the furnace between guide pegs and this, together with a light back tension, keeps them separate in the furnace.

* * *

The take-up block units are split up into four or five sections, each with an independent variable speed drive; this permits a wide range of sizes being run at the same time. The flexibility of this system enables a 24 hour programme to be worked instead of a weekly programme necessary for a single drive block unit. Figure 7 is a general view of the plant from the block end.

Fig. 7 — General view of drawing blocks. *

Davenport and Bain, in a classical investigation, determined the rates of transformation of austenite at temperatures below its region of stability. From their work a better understanding of the heat treatment of steel was gained. Figure 8 shows the type of diagram evolved from their work. The diagram variously known as the isothermal diagram, S curve or time — temperature — transformation (T.T.T.) curve, is a convenient means of showing graphically the time required for austenite to transform at any temperature below this range of stability and enables one to anticipate the behaviour and the structural changes which will occur when a given steel undergoes transformation from the austenite state. The form of the curve depends on the composition and grain size of the austenite that is undergoing transformation.

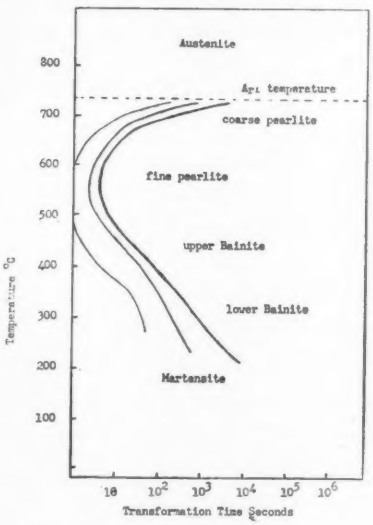


Figure 8
An isothermal transformation diagram of a 0.85% C steel

* * *

The progress of transformation can be followed experimentally by a variety of methods most of which are based on the measurement of a physical property of the steel, for example electrical resistance, which changes as the transformation of austenite progresses. A more convenient method is to examine the microstructure. A group of small specimens of the steel under examination are quenched from above the upper critical temperature, the soaking temperature should be such that a homogeneous austenite is obtained, they are then quenched into a lead bath held at a chosen constant temperature. The specimens are held in the bath for various intervals of time. At the end of each interval one specimen of the group is withdrawn and quenched into iced brine, and examined microscopically to see the extent of decomposition of the austenite that has taken place. Any austenite which remains untransformed, after its stay in the lead bath, transforms to martensite when quenched in brine.

* * *

Thus the rate of decomposition of austenite at a chosen temperature is measured. Figures 9-14 show the progress of austenite decomposition at 500°C.

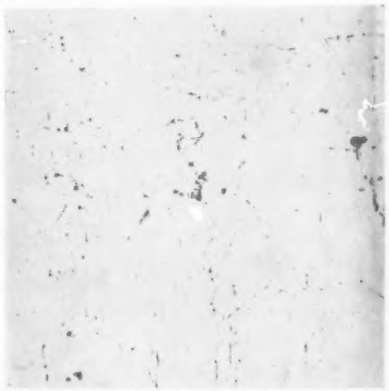


Fig. 9

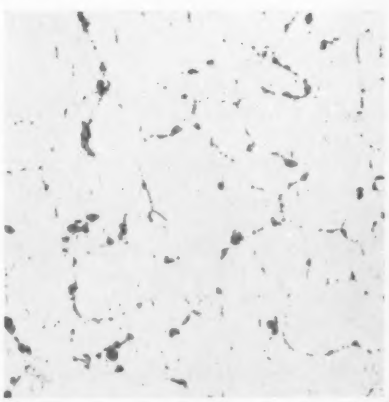


Fig. 10

Figs. 9-14 show the progress of isothermal transformation of 0.56C, No. 5 S.W.G. rod in lead at 500°C.

Similar groups of specimens are held at each of a number of lead bath temperatures until the rates of decomposition at all temperatures from 723°C., downwards are explored. For temperatures below

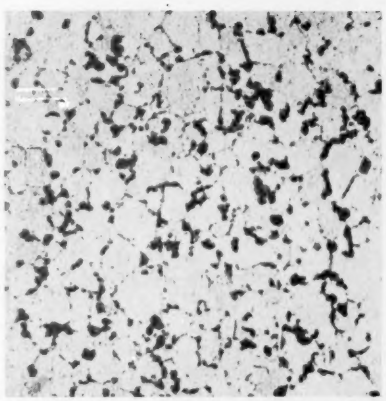


Fig. 11

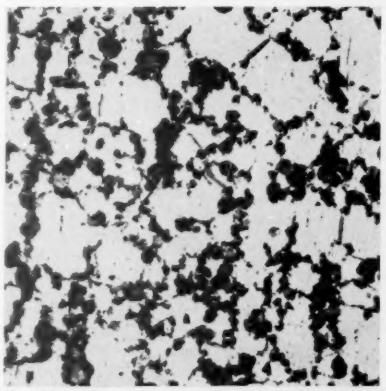


Fig. 12

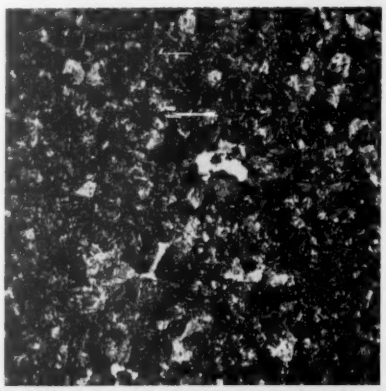


Fig. 13

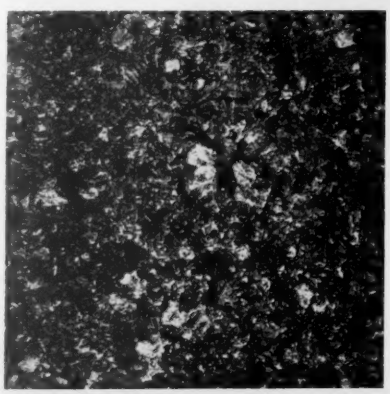


Fig. 14

the melting point of lead it is necessary to use an alternative quenching medium, for example a lead/tin alloy.

* * *

The course of transformation is shown in the upper part of Figure 15 where the percentage of austenite transformed is plotted against the corresponding time. For any one steel, a series of these graphs each representing a different temperature level can be summarised in a single diagram as illustrated in the lower part of Figure 15. The various fields of the diagram are indicated; A. represents untransformed austenite, F. represents ferrite and C. carbide.

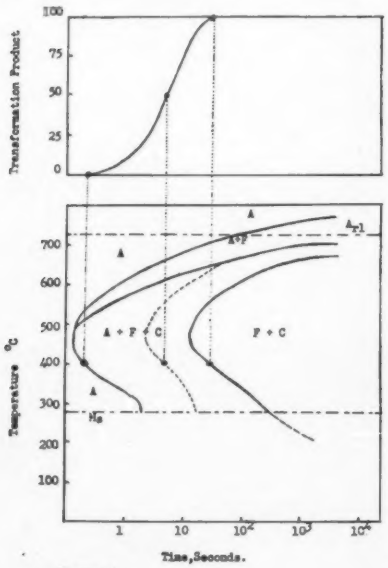


Figure 15
Typical isothermal transformation curve at a single temperature related to the complete diagram

When the lines of the diagram are considered in order from left to right the first line indicates the start of transformation at any temperature level. The field to the left of this line, is marked A to indicate that in this time-temperature region the steel is entirely austenite and is often referred to as the 'incubation' period. The portion of the curve in which the sharp change in direction occurs and the 'incubation' period is at a minimum is called the 'knee' of the curve.

* * *

In hypo-eutectoid steels at temperatures between the lower critical temperature and the 'knee' of the curve initial transformation consists of the separation of proeutectoid ferrite, the field in which this transformation takes place is marked A & F. This ferrite precipitation is followed without interruption by the simultaneous separation of ferrite and carbide in the form of pearlite, the second line marks the start of this transformation.

* * *

Below the knee of the curve initial transformation is of ferrite and carbide, thus only a single beginning line is shown. A & F & C indicate that austenite, ferrite and carbide coexist in the same time-temperature region.

* * *

The right hand line represents the time for completion of transformation at each temperature level. The field to the extreme right marked F & C indicates that all austenite has been transformed and the structure consists entirely of ferrite and carbide.

* * *

The lower portion of the diagram shows the location of Ms temperature or the highest temperature at which martensite is detected on continuous cooling of austenite at rates faster than the critical cooling rate.

* * *

The diagram does not indicate what microstructure will be expected after transformation at any given temperature, the only constituent shown is proeutectoid ferrite. Pearlite is produced at temperatures between the lower critical point and the 'knee' of the curve; just below the lower critical temperature the pearlite produced by isothermal transformation is of the coarsely lamellar type. As the temperature decreases it becomes finer and on reaching the 'knee' is unresolvable, at a magnification of 1000 X. Below the 'knee' the product of transformation is 'Bainite' the microstructure of which is acicular consisting of a fine dispersion of carbide in the ferrite matrix.

* * *

There are two forms of Bainite, that which is formed just below the 'knee' of the curve is termed 'Upper Bainite' and that formed at lower temperatures, approaching the Ms temperature 'Lower Bainite'.

* * *

The properties of the steel are greatly affected by the temperature at which transformation occurs and are dependent on the microstructure. At the higher temperatures where coarse pearlite is produced the steel is soft and ductile, with decreasing temperature the hardness increases with an associated decrease in ductility.

* * *

Steel composition has the greatest effect on the form of the isothermal transformation diagram. The general effect of alloy addition to the steel is to move the diagram to the right or in other words increase the time required for complete transformation. In addition to the general move to the right some alloying elements, chromium for example, alter the shape of the curve in the region of the 'knee' (Figure 16) ; the time for complete transformation to occur in this instance is greatly increased.

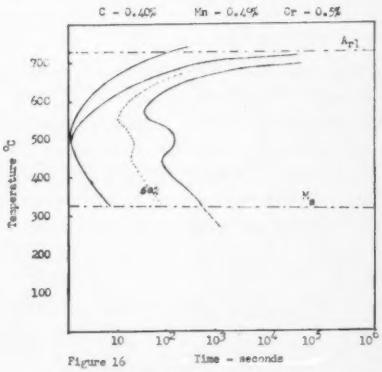
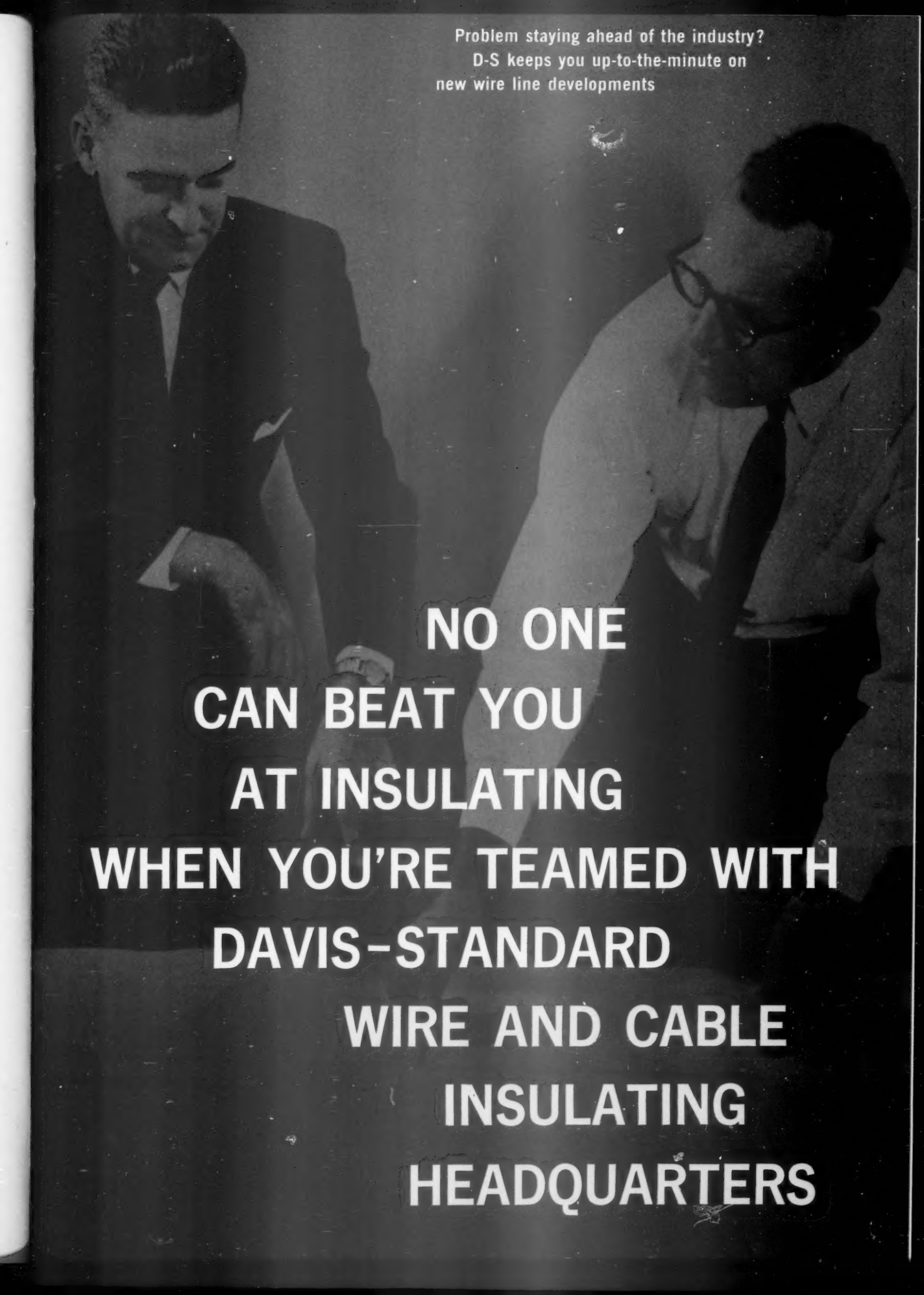


Figure 16
Showing how the presence of chromium affects the form of the isothermal transformation diagram

In view of the effect of alloying elements, in many applications it is necessary to produce an isothermal transformation diagram for every cast of steel used. However if the steel is kept within specified limits of composition and the behaviour within these limits is known and allowed for during heat treatment, it is possible to standardise the heat treatment, working to the maximum time shown by the diagram when all alloying elements are at the top of the specified range.

* * *

Although isothermal transformation diagrams are produced by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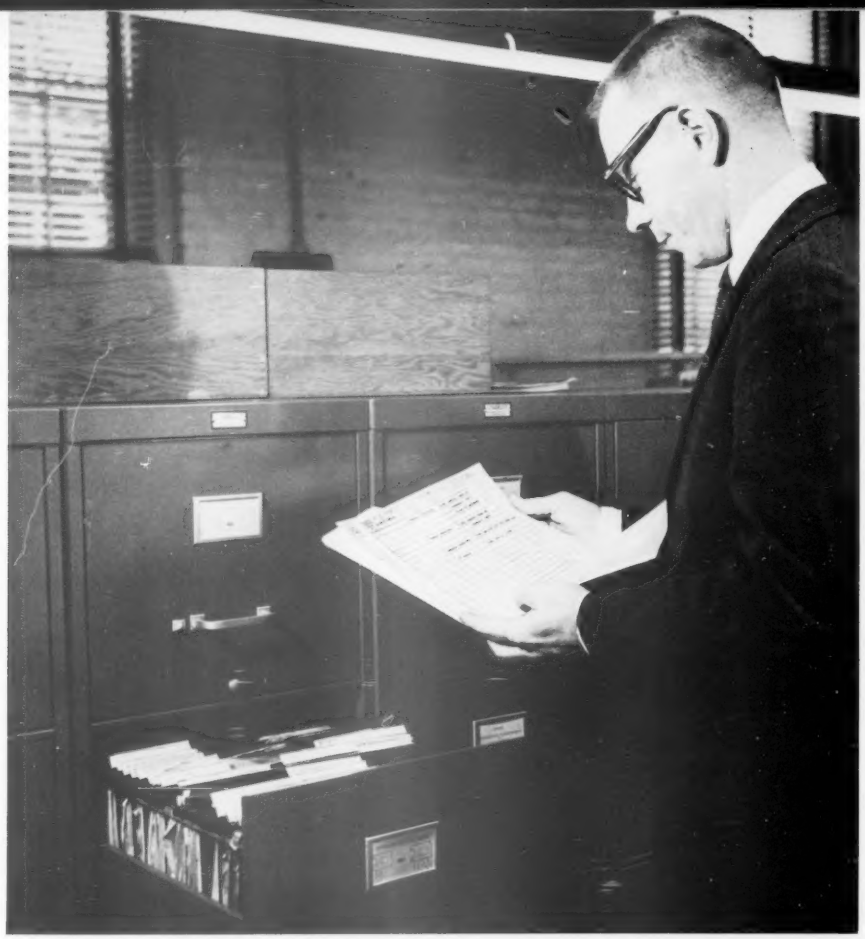

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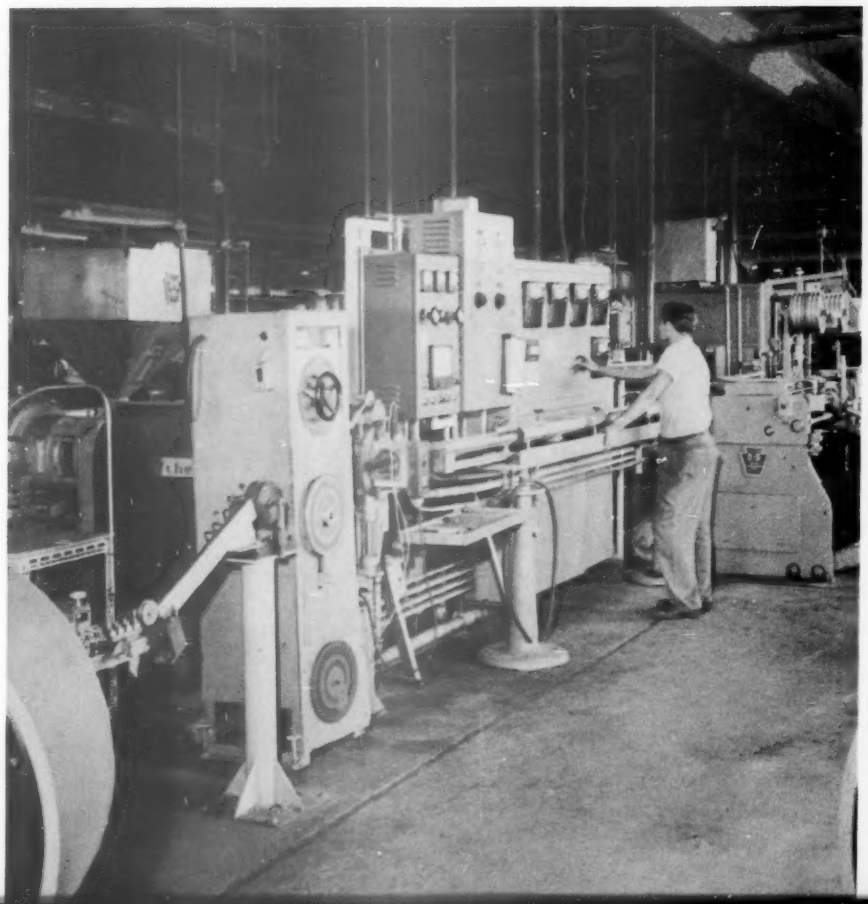

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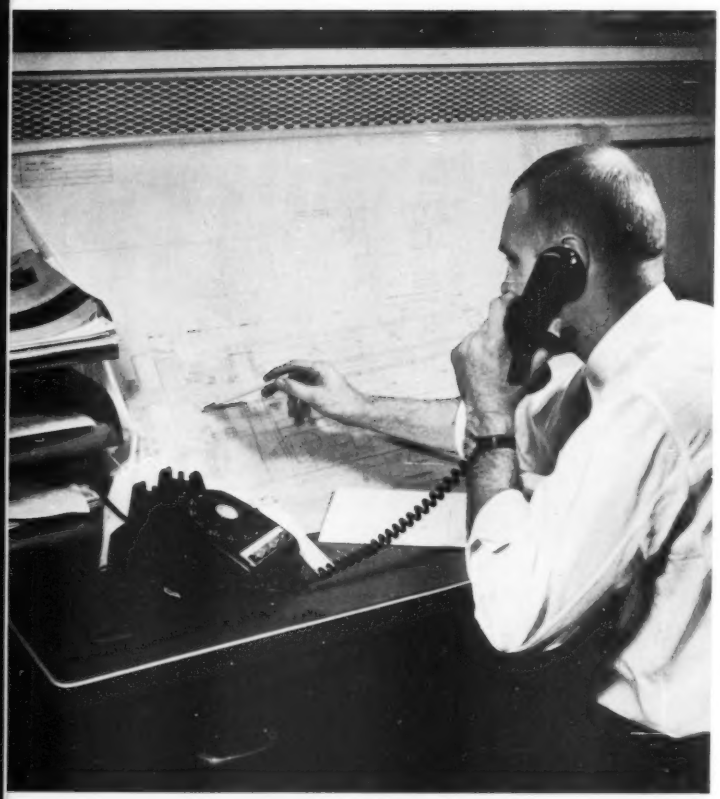

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examining the effect of transformation at constant temperatures it is possible to correlate continuous cooling curves with them.

* * *

Figure 17 shows a typical isothermal transformation diagram on which four continuous cooling curves are superimposed. Curve A

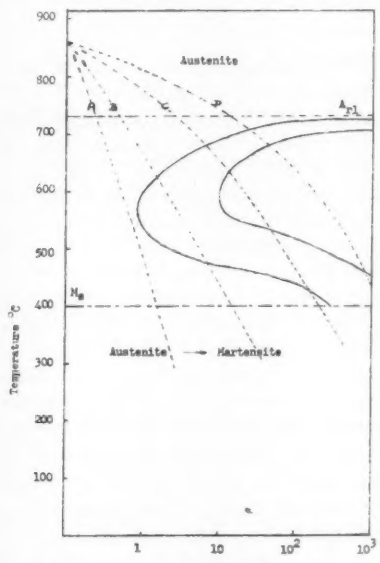


Figure 17

Co-relating Continuous Cooling curves with an isothermal transformation diagram

shows a rapid cooling rate which misses the 'knee' of the I.T. diagram; the resulting microstructure consists entirely of martensite. The slower cooling rate represented by curve B results in a microstructure consisting of martensite with some pearlite, the latter being produced by transformation where the curve passes through the 'knee' of the I.T. diagram; only partial transformation occurs as the cooling curve does not pass through the line of the diagram denoting complete transformation. Curves C and D are of slower cooling rates and pass through the I.T. diagram; complete transformation occurs but the products of transformation differ — pearlite is formed but is more coarse with the slower cooling rate shown by curve D.

* * *

Transformation during continuous cooling occurs therefore over a range of temperature and because of this a range of transformation products can be expected in the microstructure. Hence pearlite varying in coarseness can often be observed in an air patented steel (Curve C), the coarse pearlite being the first to form at high temperatures and fine pearlite formed by transformation at lower temperatures.

* * *

Lead Patenting is a process based on isothermal transformation. It can be observed in the diagrams of plain carbon steels that the minimum time for complete transformation is in the region of 500/550°C and is generally less than 12 seconds. In order to obtain a very fine homogeneous microstructure the lead bath temperature is maintained at 500/510°C., which is to the bottom of the 'knee.' Figure 18 shows the cooling curve of the lead patenting process and Figure 19 is a photomicrograph at a magnification of 1000 X of a well lead patented 0.6% carbon rod.

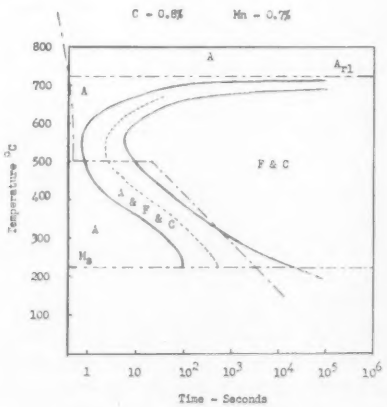


Figure 18

The cooling curve during lead patenting related to the isothermal transformation diagram

Fig. 19 — Photomicrograph of a lead patented 0.6% C, No. 5 S.W.G. rod. X 1000 * * *

In practice a minimum transformation time of 15 seconds is allowed for, as mentioned previously, small amounts of alloying elements such as chromium increase transformation times; it is therefore necessary to allow for their presence.

* * *

The furnace operating in the region of 1000/1050°C., is similar to that used for air patenting, at the exit end however a cowl is fitted which maintains a slightly reducing atmosphere, for it is essential to prevent the formation of a thick scale which, if allowed to form, would result in a carry through of lead on the patented rod. The lead bath contains approximately 55 tons of lead, the rods passing under two grooved rollers. The length of travel in the lead before the rods pass under the first roller must be sufficient for them to cool to the temperature of the bath otherwise it is possible to quench a curl into the rod which emerges as a helix.

* * *

On leaving the lead the rods pass through a sand tray which removes any lead from the surface; cooling is effected by a water cascade after the sand tray. Figure 20 is a photograph of a lead bath.

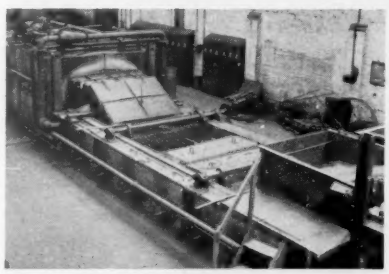


Fig. 20 — The lead bath. * * * *

The lead bath is bottom heated by gas burners, but they are not normally required when the plant is running for there is usually sufficient heat carried into the lead by the incoming rods to maintain the temperature; in fact, there is usually an excess and it is necessary to dissipate this from the surface of the lead. Normal radiation however is usually insufficient, and forced cooling is therefore necessary; the surface area of the bath can be increased by floating cooling plates on the lead (See Figure 20). Cooling plates are of a 'T' section mild steel, the leg of the section stands up from the lead surface. Forced air cooling is also necessary, this is automatically controlled thus

enabling the lead to be kept within ±5°C. Better control over the lead bath temperature, together with uniformity, can be achieved by recirculating the lead. This can be carried out by drawing off lead from the exit end of the bath by means of a pump and feeding back into the bath in the vicinity of the cowl. Normally there is a temperature gradient along the bath, with the more uniform temperature provided by recirculation a more efficient quench can be obtained.

* * *

Salt has been used as an alternative to lead as a quenching medium but it does not provide such an efficient quench; there are also the dangers associated with its handling and use, because of which it finds little favour.

* * *

The presence of copper as a tramp alloying element in the steel, merits mention at this point. Its presence can be tolerated in small amounts but if it is in excess of 0.2% its effect is noticed on the surface of the steel. At the high temperatures (1000/1050°C) used in patenting copper causes hot shortness which results in breaks in wiredrawing and brittleness in the finished wire; breaks often occur during patenting frequently in the lead bath itself.

* * *

During the patenting of large rods breaks sometimes occur in the lead bath due to another form of brittleness. Steel has a tendency to become brittle at the temperature of the lead bath, and a tensile stress formed in the surface of the rod — by bending — will, if sufficiently high, form cracks at right angles to the axis of the rod. Figure 21 shows a fracture which has resulted from a "blue-brittle" crack, the original crack can be seen as a small dark semi-circle which is characteristic of this form of failure. If the angle through which the rod bends when passing under the sinking roll is too sharp blue-brittle cracking may be experienced.

* * *

Previous mention has been made of the effect of alloying elements on the time required for isothermal transformation to proceed to completion. Chromium and manganese,

Fig. 21 — A patented rod that has fractured due to the presence "blue brittle" crack.

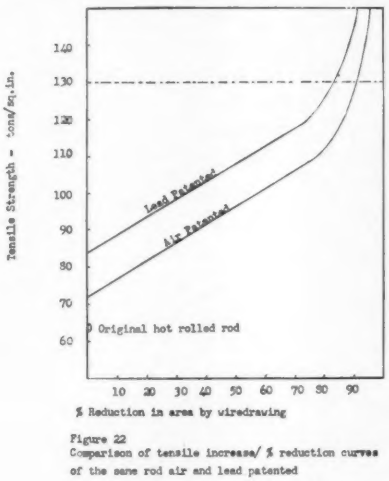


Figure 22
Comparison of tensile increase/ % reduction curves of the same rod air and lead patented

if present in excessive amounts, will give rise to brittleness in the finished base due to the presence of martensite which is formed when transformation does not go to completion.

* * *

A minimum transformation time of 15 secs is allowed but this is often exceeded. Running speed is dependent on the heating capacity of the furnace, the thicker the rod therefore the slower the running speed. Hence a 7/0 rod may be in the lead bath for up to 2 minutes, this is not detrimental for once transformation is complete no further alteration to the structure or physical properties occurs.

* * *

A different form of heating is employed in the Trauwood process, an electric current is passed through the wire or rod, the resistance of which heats the wire. Contact is made by two lead baths, the second bath also acting as the quench bath. By varying the applied current the temperature is controlled. The chief difference between this form of heating and gas heating is that the wire is quenched on a rising temperature whereas it is normally preferred to quench with a falling temperature.

* * *

Lead patenting has several advantages over air patenting. It produces a very ductile base yielding high bends in the finished wire; a greater gain in tensile strength is obtained and high tensile strength wires can be produced without over drawing. Figure 22 is a graph of increase in tensile strength with reduction of area for the same 0.75% Carbon steel, in the air patented and lead patented condition. It will be seen that the initial tensile strength of the lead patented base is much higher than that produced by air patenting, hence it is necessary to draw the latter much further to develop the same tensile strength.

* * *

The torsion values of wire drawn from lead patented material tend to be somewhat lower than that drawn from air patented material, this is due to the smaller grain size and limited amount of cold work.

* * *

It has been shown (1) that wire drawn from lead patented rods withstands wear without embrittlement far better than air patented materials, this is of great importance when considering the production of heavy duty haulage ropes.

* * *

The uniformity of lead patented material permits standardisation of wiredrawing practice and enables the properties of the finished wire to be predicted with reasonable accuracy.

REFERENCE

(1) R. S. Brown
"Wear resistance of Wire for Wire Ropes" — Wire & Wire Products, 1948

Manufacture and Properties of Rope Wire
Wire Ropes in Mines

Test Report: Man-Made Diamonds for Diamond Die Finishing

by

Jack Wiziarde
Sales Manager
Abrasives Division
Elgin National Watch Company
Elgin, Illinois

and

E. L. Kapernaros, Manager
Diamond Application Engineering
Metallurgical Products Department
General Electric Company
Detroit, Michigan

Since the introduction of General Electric Man-Made diamonds in 1957, they have demonstrated superiority of performance in a broad range of diamond grinding wheel applications. This was true first in resinoid and vitrified bonded grinding wheels with Type RVG Man-Made diamond, and later, in metal bonded grinding wheels with Type MBG Man-Made diamond.

* * *

More recently, Man-Made diamond has become available in still another important application area — lapping compounds for diamond wire drawing dies. The Abrasives Division of Elgin recently announced the availability of Dymo-D, a new compound containing General Electric Man-Made diamonds for use in diamond die finishing.

* * *

The G.E. material has been processed by Elgin for shaping, sizing and compounding to achieve a highly satisfactory end product suitable for industrial use. Crushing and grading techniques were developed to best suit G.E. diamond, and compounding procedures were varied to produce proper wetting and dispersion properties.

* * *

Both field and laboratory tests have been completed now and these tests have yielded some valuable information. Following correlation of all test data produced thus far, both field and laboratory, Elgin has found that the Man-Made diamond — when expertly graded, particle shape controlled, and compounded — gives excellent performance in diamond die applications using three micron and coarser sizes.

Mr. Wiziarde

Mr. Kapernaros

Much interest in General Electric's synthetic diamonds has been evidenced. Opinions heard have expressed both for and against reactions. Here, however, are recorded data derived from actual tests made under mill use conditions.

* * *

The field tests were conducted in the diamond die repair shop of a leading wire manufacturer. Here natural and Man-Made diamonds were compared side-by-side with all conditions of grading being exactly duplicated by Elgin.

* * *

The test equipment was a 25 head individual motor type (Pohenkra) machine, used for repairing diamond dies above .0018". Each machine mounts 25 heads in a straight line. A circular table 1-1/8" in diameter is located under each head for mounting each die. Each table is mounted on a single phase induction motor. The motor shaft is vertical, and rotates the table and die in a horizontal plane at the same speed.

* * *

In these tests the operator pointed the needle every hour and added the diamond abrasive every thirty minutes. In some of the experiments, diamond compound was added every hour or at longer intervals. The equivalent of 276 dies were subjected to repair tests and approximately 1,340 hours of machine die repair time was consumed. In general, dies were tested in pairs. Each pair of dies was approximately equal in size and subjected to repair equal lengths of time. One die of each set of two dies employed the use of natural diamond powder and the other die used the G.E. Man-Made diamond powder.

* * *

The complete test program was broken down into three major groups, as follows:

Group A — **Forty-one sets of dies were tested consuming 380 machine hours and 15 to 25 operator hours using 1-5 micron sizes.**

Group B — **Twenty-nine sets of dies were tested consuming 280 machine hours and 12 to 19 operator hours using 8-22 micron sizes.**

Group C — **Sixty-eight sets of dies were tested consuming 680 machine hours and 27 to 40 operator hours. Various size dies were used and three different particle size ranges of 0-2 micron, 1-5 micron, and 8-22 micron were used.**

* * *

As is indicated above, Group C was more extensive and also included a wider range of micron sizes. Since the results in Group C correalted closely with Group A and B the discussion of results can be confined to Group C.

* * *

Group C consisted of three broad experiments. Experiment No. 1 consisted of 32 sets of

(*Please turn to page* 1592)

A CLARK EXCLUSIVE ...SPOOLS FOR INSULATED WIRE & CABLE WITH A CONTINUOUS LOCK SEAL BETWEEN ENDS AND CENTER

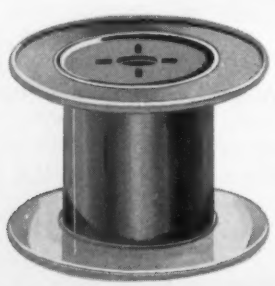
New Clark Single-Center Nonreturnable Fine Wire Spools

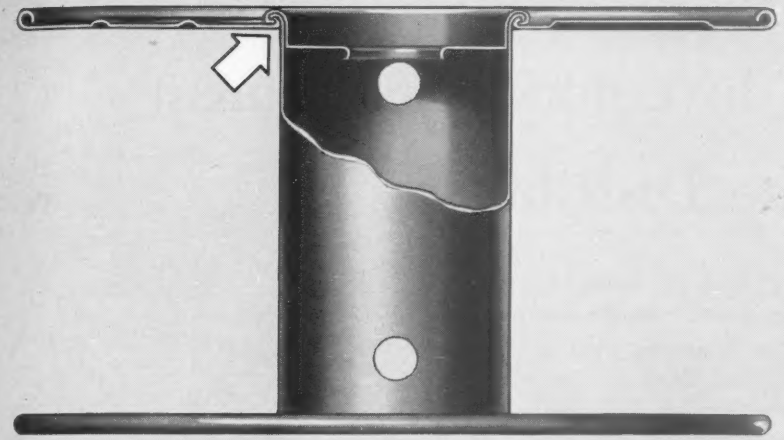
The latest addition to the Clark line of wire packaging products is a new single-center fine wire spool with a 3½″ diameter center and 6″ diameter ends. Lighter in weight and costing far less than many conventional heavy-duty types, this new spool offers new opportunities to fine wire manufacturers for cutting packaging and shipping costs, as well as providing the ideal nonbreakable package for other heavy-duty applications.

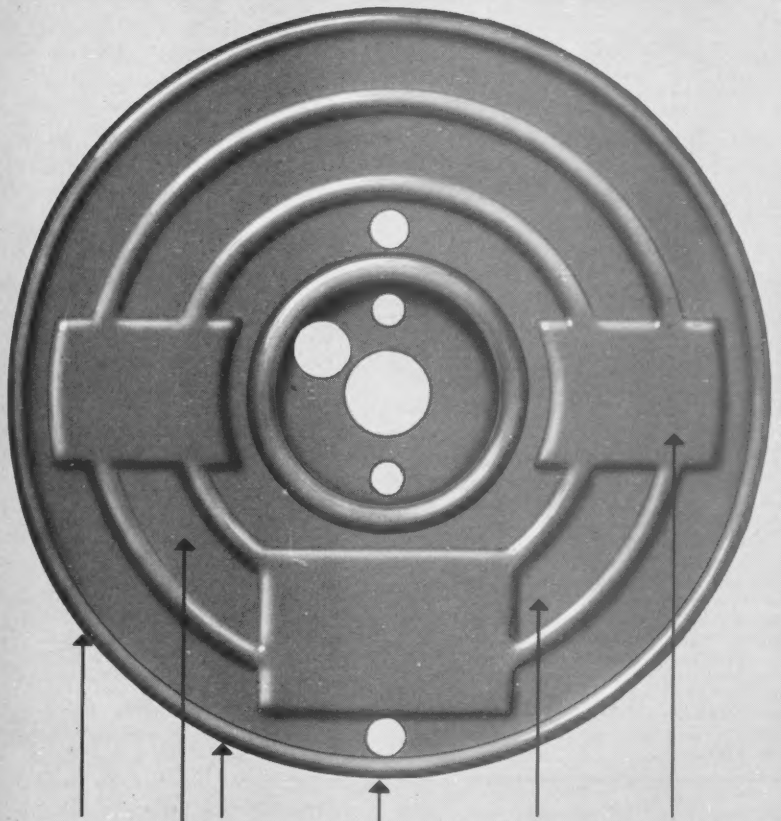
Although weight has been reduced appreciably, there has been no sacrifice of strength and rigidity. This spool is unbreakable in normal usage.

Extra costsavings are also possible, since this new Clark spool is designed for use on nonreturnable basis, eliminating the need for expensive deposit credit bookkeeping.

Write, wire or phone today for further information and samples of this latest product of creative spool engineering and precision manufacturing at Clark.







Edges of Clark spool ends are fully curled to prevent snagging and damage to wire or insulation.

Clark spools can be shipped with ends and centers packed separately to save space. Assembly is simple and rapid with a hand arbor, foot or power press.

The outside of spool ends is coated with a finish which permits extra rubber-stamping of special information by you or your customers.

Ribs are available with and without identification panels. Special arbor and drive holes can be incorporated to meet requirements of your winding machines.

End diameters available are 3-3/4", 5", 6-1/2", and 10-1/2" with 1-15/16" dia. center. A 3-1/2" dia. center is also offered with a 10-1/2" dia. end. A special 16-1/2" dia. end can be ordered with a 5" center. Centers from 1" to 13-1/2", depending on type, size, and capacity.

As final protection for the inside of spool ends and outside of centers, Clark applies a high-bake phenolic coating impervious to lacquers used to protect insulation.

For insulated wire and cable, or for fine wire requirements, the sturdiest and most effective package you can buy is an all-metal spool, custo engineered by J. L. Clark. One important reason an ingenious locking operation which insures a continuous, reinforced bond between the center and ends, leaving no raw edges exposed to snag cut. This sturdy locked seam guarantees center rigidity and secure assembly, making the Clark spool one of the strongest on the market today.

Clark spools can be assembled twice as fas as other spools!

Center and ends are joined in your plant by a simple hand arbor, kick or power press operatior since there is no alignment or indexing of parts necessary. Assembling tools and kick presses are available from Clark at nominal cost to users of these spools.

As part of Clark's integrated spool service to customers throughout the country, we offer complete facilities for creative design and graphi styling, assuring instant identification of your brand and product. Award-winning metal lithography by Clark provides distinctive eye appeal in addition to complete product protectio

Whatever your spool requirements—insulated wire, cable, solder, enameled wire, or fine wire—you can rely on Clark spools for superior performance. A Clark representative will be glad to discuss your specific requirements with you. You will find him helpful and capable of offering constructive suggestions on how you can get maximum value for your spool dollar.

Clark spools are still the standard by which all others are judged.

J. L. CLARK

J. L. Clark Manufacturing Co.
Rockford, Ill.; Liberty Division Plant and Sales, Lancaster, Pa.; New York Sales Office, Chrysler Bldg., N. Y. 17

Introduction to Inventory Management for the Distributor

by John O. Todd, Jr.
Special Representative, Distribution Industries
Data Processing Division
International Business Machines
Los Angeles, California

We all know the distribution industry is important, and we know that they're facing some very perplexing and serious problems. The question is how can we make IBM more profitable to the distribution industry as soon as possible. There are several approaches we might use. One is the total systems concept. You have perhaps heard about the total systems concept. It has proven successful in the M.O.S., the SURE project and in the SABRE project for the airlines. As you know IBM's committed to several total system studies throughout the United States. Gentlemen, this is a way of life in the IBM Company, so why not use this approach for the distribution industries?

* * *

Now as we look at the distribution industries we find that they are a very heterogeneous group. There are dairy, auto parts, hardware and groceries—to name just a few. It is impractical to design a total system for each of these industries in the near future so let's select just one: groceries. The reason that we select groceries is that we know so much about it, and IBM has deep penetration in this industry. We can go to work, and design a total system for the grocery industry, but it will help perhaps only twenty-five customers in the Western Region.

* * *

Well this just isn't enough, so let's back off from the total system study and look at another possible means of helping all of the industries in Distribution. Let us take a specific application

John O. Todd, Jr.

A paper presented at the West Coast Regional Meeting of The Wire Association on June 22, 1961, at San Francisco, California.

Mr. Todd holds a degree of B.A. from Amherst College, received in 1950. In 1952 he received a degree of M.B.A. from Wharton Graduate School, University of Pennsylvania. After a period of Military service with the United States Navy from 1952 through 1955, he joined a Pension & Deferred Profit Sharing Consulting Company in San Francisco. In 1957 the author joined IBM, San Francisco on Data Processing Sales and was promoted to his present position in 1960.

such as purchase order writing, route accounting, sales analysis, inventory control or accounts receivable. Now with any one of these we could be assured we could do a professional and knowledgeable job in developing an application that would be suitable to all industries. Before we pursue this further let's describe the typical type of customer that we are going to help. He might look like this — $10-000,000 in sales, an average inventory value of $3,000,000. $3,000,000 in inventory would represent three or four turns annually. This wholesaler has 40,-000 items in inventory, and on these 40,000 items he is realizing a 20% gross profit but out of the 20% gross profit he is only taking a 1% net profit. This is a realistic figure for many industries are working on considerably less than 1% gross profit.

* * *

The annual inventory maintenance cost is 15%. The average percentage of shorts is 10%. A short condition in a warehouse simply means this, that when he receives an order and he's not able to fill it, we call it a short. He's lost that sale and the profit from that sale. 10% is common in the industry and some are running as high as 25%. The average accounts receivable is $1,000,000 of which 200,000 is overdue. He's paying 6% for his borrowed money.

* * *

Well let's approach now some typical applications. The first one will be accounts receivable. Let's assume that through accounts receivable procedure we can completely eliminate the overdue. This would add a total of $12,000 to his net profit.

* * *

Another excellent application is sales analysis. Let's assume again that we do a superlative job. Let us say we provide such excellent sales information that the customer increases his sales 25%. This will add $25,000 to his net profit annually.

* * *

Another logical area is inventory. There is a $3,000,000 investment in inventory. If through inventory control we reduced his inventory 20% and at the same time reduce the short position

from 10% to 5% we will add $140,000 to the net profit. This is 140% more net profit than he is realizing today.

* * *

Well it now appears logical that if we are to pursue any area the most important one financially is inventory. There is another reason that we should realize that inventory is such an important area. This is because the economic existence of the distributor is completely dependent upon inventory. It is not economically feasible for the manufacturer to distribute directly to the consumer so between them there is this middleman, the distributor. I'd like to call him "Mr. Inventory". So now we have determined that inventory is really the heart of this business. Have we really now backed off from the total systems concept? If we can do a good job in the inventory area then we are taking care of the heart of his business. Inventory control is an old subject that we learned in sales schools, we have installed it, we have sold it. It's something that all of us know something about. But maybe I'm not talking about inventory control as we have known it. When I envision inventory control I think of 40,000 balance forward cards. We are passing all the issues against these 40,000 cards and creating a stock status report on a weekly or a monthly basis. This, gentlemen, is the old method of IBM inventory control.

* * *

I'm talking about an entirely new application which we will now call inventory management. This means that the distributor will be managing his inventory instead of having the inventory manage him. When we approach an entirely new area such as inventory management and believe me, this is a new area, there are some very serious problems. They are not unlike the problems that were faced by our scientists several years ago when they were trying to put a satellite into orbit. If we relate our problems to theirs then the question is how are we going to put inventory management into the profit orbit. Now if we're going to accept responsibility for an entirely new application (inventory management) we must be prepared to sell in a truly sound manner. We have to realize we're dealing with some big dollars in this and if we are going to do a job and professionally sell inventory management we must have a sure-fire method of reducing the inventory costs, at the same time increasing sales.

* * *

Let's further examine our rocket and see how it is constructed. The first stage is record keeping. Record keeping is the primary area inventory that IBM equipment occupies today. A good portion of IBM revenue in the distribution industry is coming from the inventory record keeping area, and it is profitable to IBM but is this a profitable area to the customer? Most of the equipment installed in record keeping was justified on the basis of reduced clerical costs and increased speed, economy and flexibility. The real profit to the customer lies in the next two stages which we will discuss later—the inventory analysis and the inventory science stages.

* * *

Unfortunately, a careful look at the record keeping stage shows we often have difficult conversions. Sometimes they fail, the inventory program doesn't even get off the ground. Now this is the place to stop, take stock, and be practical. We can say that we have been doing a good job in the record keeping area but we all know that we haven't been doing the best possible job and there are several reasons why. The primary reason is that it is difficult for us to justify equipment in this area. We are usually selling against clerical costs and we haven't given the customer the real reason to buy equipment. The other reason is it is a difficult application to install. Let's relate it to some other applications: payroll, accounts receivable, accounts payable, billing. In any one of these when we design the procedures every facet of these applications is tied into a control point. Where do we find in inventory record keeping this same type of control? With the kind of dollars we are talking about here, it is even more important to control the dollars in inventory record keeping than it is in accounts receivable. It's our responsibility to change chaos into complete organization.

* * *

We have looked at these chaotic conditions and analyzed how the successful customer converts them into order. From there we have developed some ground rules or prerequisites to successful inventory record keeping conversion. Let's review some of these prerequisites. Number one is that they established a gradual cutover schedule. Any of us are being over optimistic to say that we can cut over billing, inventory control, accounts receivable, sales analysis, all at one time. It has to be done step-by-step, and this can take from eight to eighteen months.

* * *

The billing must be mechanized and it must be mechanized properly and running smoothly.

* * *

We must have rigid document controls. A good example of this is that all receiving reports should be machine prepared so that we have an accurate entry in the way of item number and quantity into the inventory system.

* * *

We must have an accurate physical inventory and this physical inventory is taken only after the billing is running smoothly and after the rigid document control has taken place.

* * *

There also has to be a tight correction procedure. In the manual system with a Kardex file there is correction procedure. One of the biggest disadvantages of a Kardex file is that

it is operated by a pencil. Unfortunately, the pencil has two ends, one with lead in it and the other with an eraser on it. More often than not the eraser is the end that is being used. This causes a complete lack of control, which would be disastrous in a mechanized system. Therefore a new tightly controlled correction must be established.

* * *

We very often fail to recognize the importance of the file maintenance procedures and the personnel that are involved in it. This cannot be underestimated in successfully converting to machine inventory control.

* * *

The prerequisites have been discussed and all of us realize how important they are. The question is how do we sell this to the customer? If we can just barely justify the equipment how is it possible to sell control to this customer. The answer is obvious. The carrot on the other end has to be so great that he wants to do a good job of record keeping so that he can be on the way to where the big profit still lies.

* * *

I'd like to discuss specifically the analysis section of the inventory rocket for this is where part of this all important carrot is. We must discuss it specifically because our distributor is not interested in blue sky, nor is he interested in the broad brush. He wants to know specifically how to do this. The only way to be able to give him this information was to do it ourselves. We did just this by means of a case study with a wholesale hardware dealer, who is one of the leaders in his industry. They had some 30,000 items which have been successfully converted to IBM inventory record keeping. In punch card form they had accumulated nine months history and the inventory balances as of August, 1960. This customer supported our program analysis completely because he realized that it would give him profit quickly. He sat down and helped us plan a procedure designed to tell him which items were truly profitable and which were overstocked. The procedure was basically quite easy but the time it took was massive. Just because of shear volume it took six man months. We took the item cards for each of the 30,000 items and put them into a 650 computer to calculate four values: gross sales, gross profit, inventory value and number of months available. After this the cards were rearranged in a sorter several times and reports were prepared on the 407. These reports for the company as a whole and by department were items by gross profit, vendors by gross profit, and items by number of months available. From these reports these results now are available.

* * *

A large amount of profit came from a few items. Specifically 80% of the profit came from 20% of the items. The 80-20 rule is not unlike the rule that we have been seeing in IBM for sometime, namely that 20% of the items account for 80% of the transactions or sales. We see here the gross profit curve follows a similar course. The difference is that in this case the customer knows what items are in the 20%, information he never had before.

* * *

To further break this down we discovered that 10% of the items accounted for 64% of the gross profit, 3% of the items accounted for 40% of the gross profit, and 1% of the items accounted for a whopping 24% of the gross profit. This means that 300 out of 30,000 items accounted for almost a quarter of the gross profit.

* * *

The consultant who was present when we gave these results jokingly summarized an important meaning. He said "Mr. President, you know I think I'll set up a small wholesale house and I'll carry only these 300 items and let the rest of the wholesale hardware dealers carry the other 29,700." The importance here, of course, is that if this wholesaler should lose a large percentage of the sales of these items either because of the loss of a vendor or competitive attack he is going to be in financial difficulty. On the other hand if he should, through sales emphasis, increase his share of the market with his customers of these items his profit picture will take a substantial turn for the better.

* * *

The converse of this is that many items produce little gross profit. Obviously 80% of the items contribute only 20% of the gross profit, but to break this down further we found that 60% of the items provide 7% of the gross profit, a very small amount. Half the items contribute only 4% of the gross profit and the lower one third, 33% of the items, give less than 1% of the gross profit. In this 10,000 item group there is not one item that contributed more than $5 gross profit over a nine month period. This was not because of insufficient markup, as these items have the same markup as the rest of the items. This was because of lack of movement, lack of sales.

* * *

This profit relationship was similar with the vendors. That is, a few of the vendors gave a large portion of the profit and a lot of the vendors did not give very much gross profit at all.

* * *

Specifically 1% of the vendors provided 21% of the gross profit, 10% of the vendors gave 66% of the gross profit and 20% of the vendors gave 82% of the gross profit. This almost appears to be a natural law. At the lower end of the sales curve, the last 40% of the vendors gave 2½% of the gross profit.

* * *

The fourth result was that many items and dollars are in overstock. Now most wholesalers will tell you that he has some items in overstock. He will rarely tell you which particular items are involved and how many dollars are so immobilized. This wholesaler knows. Considering a basic stock of three months available we discovered that 71%

New MORDRAW Vertical Wire Block

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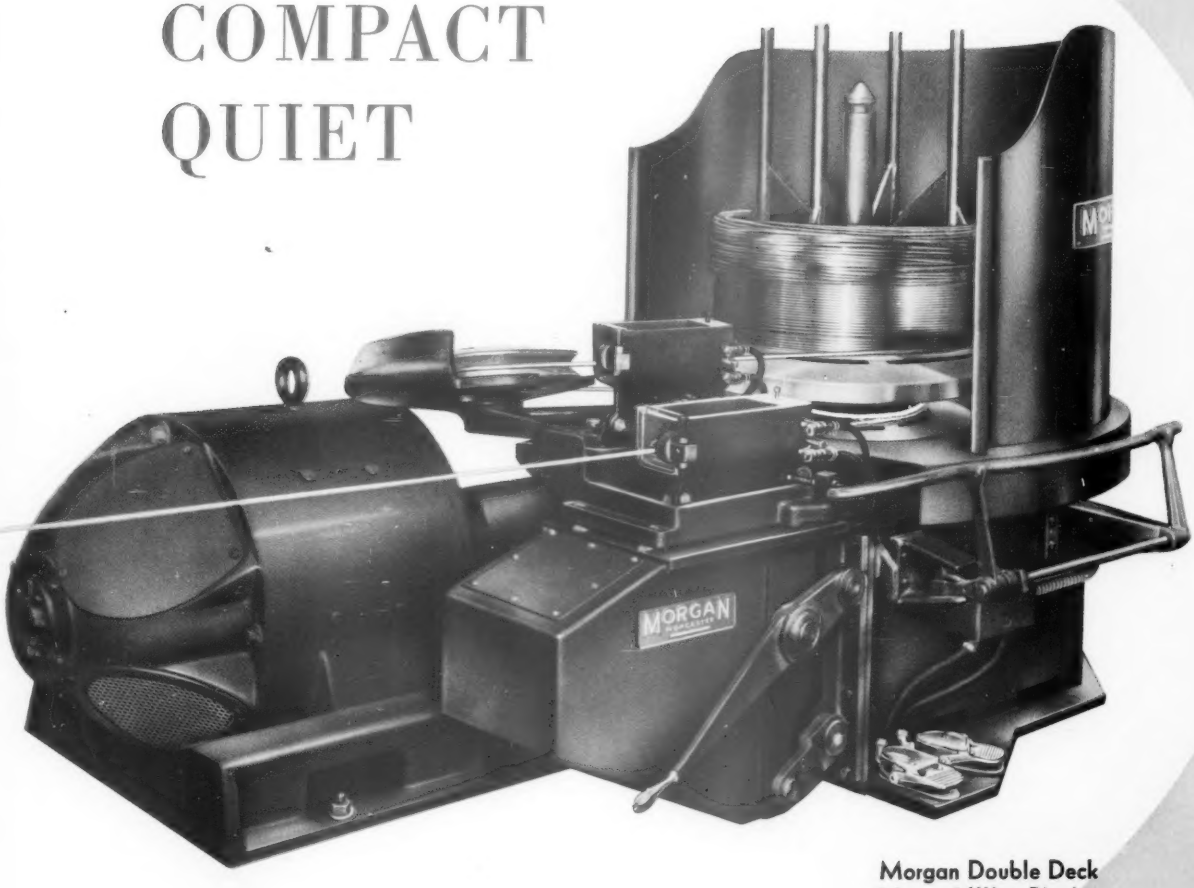

Morgan Double Deck
Vertical Wire Block

MORGAN WORCESTER

MORGAN CONSTRUCTION CO.
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of his items were in overstock and this represented 58% of the inventory value. Let's convert this into dollars with Jack's typical wholesaler example. This means in that case that out of $3,000,000, 1 3/4 millions were in overstock and if, through scientific inventory management, this could be eliminated, the carrying charges figured at 15%, some $260,000 per year, would be added to his net profit. This incidentally is more than 2½ times the net profit right now.

* * *

Gentlemen, there are a lot of dollars to be saved here — a lot to be made here. We reevaluated this on the basis of six months available which certainly is much more than any wholesale hardware dealer should have and it developed that 55% of the items were still overstocked representing close to 40% of the inventory value. No matter how you look at this there is a lot of money to be saved here by inventory management.

* * *

The objectives of this analysis that were achieved fall into two groups. First, we know where to begin the science part of our inventory management program. We know which items we must analyse in detail exhaustively in order to come up with a reorder formula that can be put on a machine. Because there's a lot of profit involved in the top group these are the ones that should be selected. Also, we know we don't have to pay a lot of attention to the items at the lower end of the scale because they aren't contributing anything to our profit anyway. In all, there are nearly 10,000 of these.

* * *

Secondly, we know where to take management action now, for we know which items are over- and understocked. We can, by going down our list, by degree of overstock, purge ourselves one by one of the dead items. We also know which items are fast moving, high profit producers and can emphasize sales to take advantage of this. This particular customer is going to put the high profit producers on a preprinted order form, unheard of in the wholesale hardware industry, and have each salesman review with each customer each of these items in an effort to capture the larger share of this market. He also knows which items rarely move and produce little profit. He knows these items don't deserve the buyer's attention on the monthly review basis and so we will have their machine monitor 10,000, one third of the items, relieving the buyer completely of this and giving him more time to more thoroughly review the more important items. He also knows which vendors are more profitable and which are not. But perhaps more important from an operational point of view he knows which items in the vendor line are profitable, and so can sit down with the vendor and say "Look here, we're carrying about a 100 items in your line, and 30 of them last year gave us no profit whatsoever. Now we are going to have to do one of two things, either drop those items or you're going to have to make it worth our while." One of the big problems in the relationship between the wholesaler and the manufacturer is that the manufacturer wishes he would carry everything in the line, even items that don't move at all. Now he can realistically evaluate which items he should carry with the vendor.

* * *

An important facet about this is that any action can be taken on a partial step-by-step basis. Each of these do not have to be revolutionary in their instrumentation. In the science area, for example, we don't have to suddenly create formulas for 30,000 items. We can work with just the top 300 to begin with and after effectively doing this, we will make some profit immediately. Then we can go on to the next 300.

* * *

Similarly in reducing items from overstock we can go from the top of the list to the bottom in order of degree of overstock. In this case it is quite interesting — they have a big number of items to begin with because over 3,000 of the 30,000 items had more than eight years supply on hand and, Gentlemen, this is one of the leaders in the industry.

* * *

This job can be done bit by bit in whatever portion the wholesaler wishes to do, yet the results will be immediate, and will make him want to go on and do the rest of the whole job.

* * *

For the past five years scientists have been doing a good deal of work in studying inventory. They've learned a lot about what factors influenced inventory level and what factors do not. The only problem is that this work has been done on a single item, and no one is ever able to intelligently develop an approach whereby we could tackle an inventory of 30, 40 or 50,000 items. So that the analysis program that was just announced becomes doubly significant, not only does it give information to management from which they can take immediately profitable action but it gives them a place to begin their scientific inventory management study.

* * *

What we're really trying to do here is to analyse the costs so that we can hold the cost of our inventory to a minimum. So let's pause for a moment and talk about scientific inventory management and begin by examining the costs involved. There are four basic types of costs —there are the fixed charges, this is the interest on the money invested in the inventory, the depreciation charges, the obsolescence cost and things of this nature — there are the warehousing costs, this is the building, the taxes, the insurance, and the cost of the people who have to run around inside this building putting things away and getting things out — there are the purchase costs, the salaries of the clerks, the cost of the paper work involved, the cost of recording and storing the goods — and there are the shortage costs. These are perhaps the most important. Already men-

tioned is the significance of the distribution wholesalers having plenty of stock on hand. This has resulted in overstock in most cases. However, they still had this terrible stockout situation. Sometimes stockouts are so bad, as Jack mentioned sometimes as high as 25% — without realizing it these people instead of running warehouses are running outhouses or something. These are the costs, Gentlemen.

* * *

Let's take a look to see how these costs interact in a typical but somewhat idealized inventory situation. We have here a case where our demand is constant and it's known to be 100 units a month. The lead time is constant and it's known. In case one our purchase quantity is 400 units. We have 100 units of demand per month. It's obvious that we need to place a purchase order only once every four months. In case two we have a purchase quantity of 200 units. We, therefore, have just half the purchase quantities and we must purchase twice as often. Case three we have a purchase quantity of 100 units, we now have to purchase four times as often as in case one. How about the inventory level? I think you can see quite easily that the average stock on hand is 200 units. Down here it's only a 100 units and in the last case it's only 50 units. How about shortages. I think you will agree that we are much less vulnerable to stockouts in case one where we at some times have as many as 400 units on hand as compared to case three where we never have more than 100 units on hand. What do we have here? These costs are all interrelated and they are all tied to the inventory level, the reorder period, the reorder quantity and the demand. The higher the inventory level the higher the fixed charges and the higher the warehousing costs. The lower the inventory level the higher the purchasing cost and the higher the shortage cost.

* * *

The problem here is really to get these two sets of costs in balance. We're trying to achieve balanced inventory costs such that we can hold the total cost of managing the inventory to an absolute minimum.

* * *

Now, Gentlemen, put yourself in the shoes of the distributor, he knows these things — he knows that his job is to determine what the demand is and what the order quantity should be and what the order period should be; but he doesn't know how to do it. What can he do? Well what he would really like to be able to do is to try it out. He'd like to cook up some forecasting technique. He'd like to try out various order quantities and he'd like to try out various order periods. How can he do this? Well he can establish a set of rules and he can put them into operation in his warehouse.

* * *

The results of this study, those of us who have been in this field for sometime, have developed a rather technical term for what might happen if you did a study like this and things didn't go quite right. The term that could happen to these guys is, well, it's bankruptcy is what it is, because if they should happen to take the wrong set of numbers here to try out, business is so tight right now that this could be the killing blow. They can't try them out in their actual warehouse because the risks are too great. Well we could build a model of the warehouse, couldn't we, and set it on top of the table and maybe somehow simulate the warehouse with this little tiny warehouse by bringing things in and bringing things out to keep track of the happenings. This isn't really very accurate, however. It tends to be rather time consuming and not altogether satisfactory.

* * *

There is another way we could simulate this sort of thing, however, and that's on a digital computer. And in recognition of this we have announced the IBM inventory management simulator. This is a digital computer program which will operate on a 1620, a 650, a 7070 or a 7090.

* * *

Alright, we have this simulator. We've talked a little bit about the problem. Let's ask ourselves this question. What is simulation? Well, that is a very good question, isn't it, yes. Simulation is sort of the application of a probabilistic stocastic process involving Tchebychev's polynomials to the LeGrange function, sort of thing. You with me so far? No, all seriousness aside, inventory simulation is very straightforward. All we are doing inside the digital computer is keeping track of the amount on hand, the amount on order, the average inventory level and things of this nature. You can think of a simulator program as being really very, very similar to a program that you might write to actually do inventory control for a customer.

* * *

Let's take one more look at the next question. Why simulate? Very simple and very straightforward. The inventory management simulator we'll be able to evaluate alternative inventory control systems. After making this evaluation, management will be able to intelligently select the system that meets their objectives.

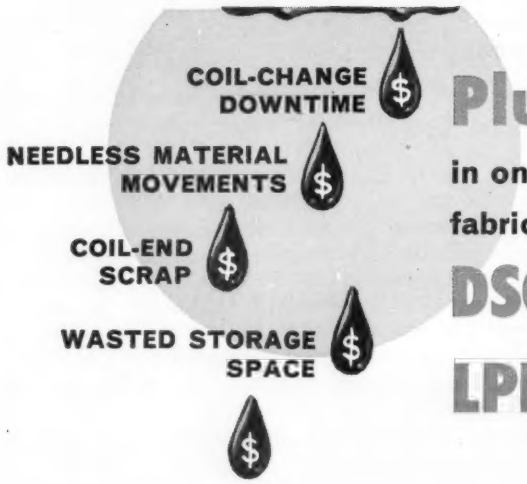
* * *

To take this one step farther and to help you understand this even better we ran the inventory management simulator with an item for twenty-four months with a purchase quantity of 300 units and here's what the output looks like. We get a great deal of information. We're only going to cover a few of the high points today.

* * *

The average stock on hand for this twenty-four month period was 175 units. It costs us $10 to purchase and we had to order ten times so the purchase costs were a $100. How about stockouts? Only 4% of the time! We filled 96% of the orders that we received. We weren't real happy with the service that we were giving the customer so we decided to add a 50 unit safety

(*Please turn to page* 1596)



Plug these Profit Leaks

in on-again, off-again brite-wire fabricating with

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HERE'S WHAT USERS SAY after switching from conventional short-run coils (150 to 400 lbs.)

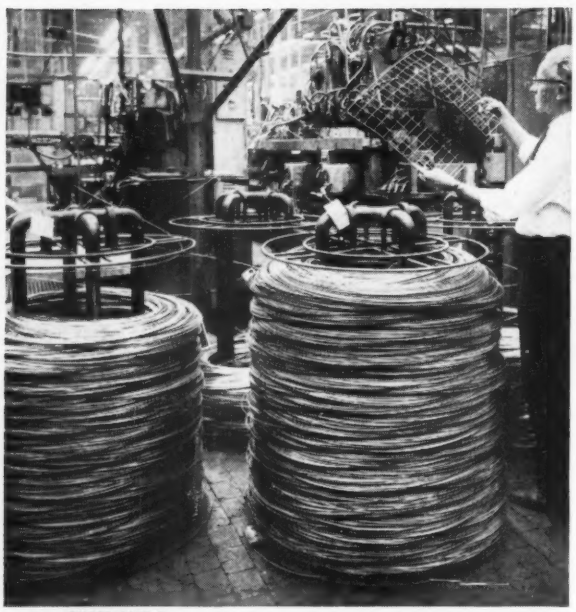

PHOTO CREDIT:
G. E. DISHWASHER DEPT.,
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DOWNTIME due to coil changing cut as much as 95%; productivity stepped up 20 to 33-1/3%; man-hour costs trimmed 20% and more. SCRAP slashed in direct ratio to coil changes eliminated per job-run (50 to 95%).

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SPACE UTILIZATION improved from 25 to 75%. Example: 120—300 lb. coils, total weight 18 tons, required 180 square feet of floor space; the same weight in 12—3000 lb. LPR's took 45 square feet—only 25% as much. Free-standing LPR's can be compactly and safely pyramided for maximum get-at-ability; helps sharpen your inventory management, too.

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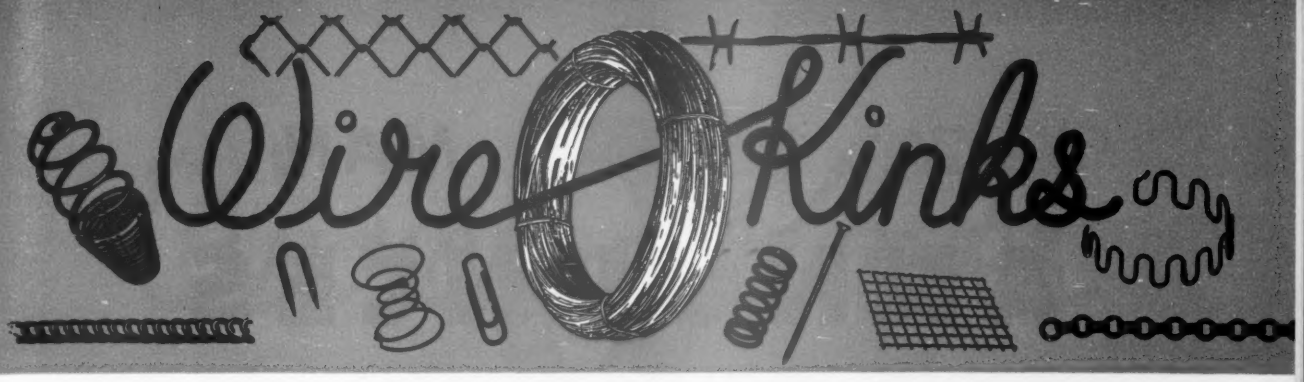


Thermocouple Wire

QUESTION

I am interested in learning something about thermocouple wire and will appreciate hearing from you on this subject.

ANSWER

While differing methods for determining temperature are employed, thermocouple wire is the most commonly used in industry because of its economy, adaptability and accuracy in most applications over a wide temperature range.

* * *

It was discovered nearly a century and a half ago that definite temperature electromotive force relationships exist in dissimilar metals. This force can be utilized to drive calibrated instruments to provide direct temperature readings.

* * *

A thermocouple can be defined as two dissimilar metals welded together, and for industrial uses, the metals are in the form of wire. Applications can range from sub-zero temperatures for refrigeration control to the high temperature ranges encountered in casting, forging and steel making.

* * *

While new combinations constantly are being developed, there are four standard combinations that encompass most of the temperature and atmosphere conditions encountered. These are

T/C Alloy	Temp. Range
Copper-Constantan	−300° to +700°F
Iron-Constantan	0 to +1400°F
Chromel-Alumel	0 to +2300°F

Readers are invited to send us how-to-do-it items for this department. For each item received that is published we will pay contributors $10.00. Your cooperation will be appreciated by us and our many readers. May we hear from you?

Platinum-Platinum Rhodium	0 to +2700°F

* * *

Selecting a thermocouple alloy best suited to a given condition is easily determined today from standardized charts issued by the thermocouple wire producers. These will provide, not only temperature ranges, but recommendations as to the suitability for specific atmosphere conditions in furnaces, etc.

* * *

Since thermocouple alloys are expensive, use is made of another grade of wire called extension wire, also called thermocouple lead-in wire. This connects the business part of the wire to the instruments. It must, however, follow the same response curve. Materials like fiberglass, asbestos and others are used for its insulation.

Tire Bead Wire

QUESTION

We have been looking for information on tire bead wire. Can you tell me something about it?

ANSWER

Tire bead wire is a patented, high carbon wire of very high quality, combining high strength, toughness, and uniformity in chemical composition. It is commonly supplied in three finishes — bright, liquor finished and bronze plated.

* * *

Standard sizes are .025″, .028″, .037″ and .043″. Very close tolerances — plus .0015″ to minus .001″ are held, with tensile strength, in the different sizes ranging from 220,000 to 290,000 psi. The wire is often referred to as Plow Steel Rope grade.

* * *

The wire is drawn and processed on standard equipment and both handled and heat treated in the same manner as rope wire.

Diamond Dies and Copper Wire

QUESTION

I am interested in finding written material related to the following subjects:

1. **Diamond Die Recutting — how the maximum number of recuts can vary with size and quality of the stone.**
2. **Elongation of Drawn Copper Wire (soft) — what should the maximum limit on elongation be if stretching in subsequent operations is to be minimized.**
3. **Analytical Calculations Regarding Weight per Thousand Feet — this is in regard to stranded or bunched copper wire whose stranding is concentric or non-concentric. There seems to be a deviation between actual and analytical, which cannot be precisely accounted for.**

ANSWER NO. 1

There appears to have been little written on the points on which you seek advice.

* * *

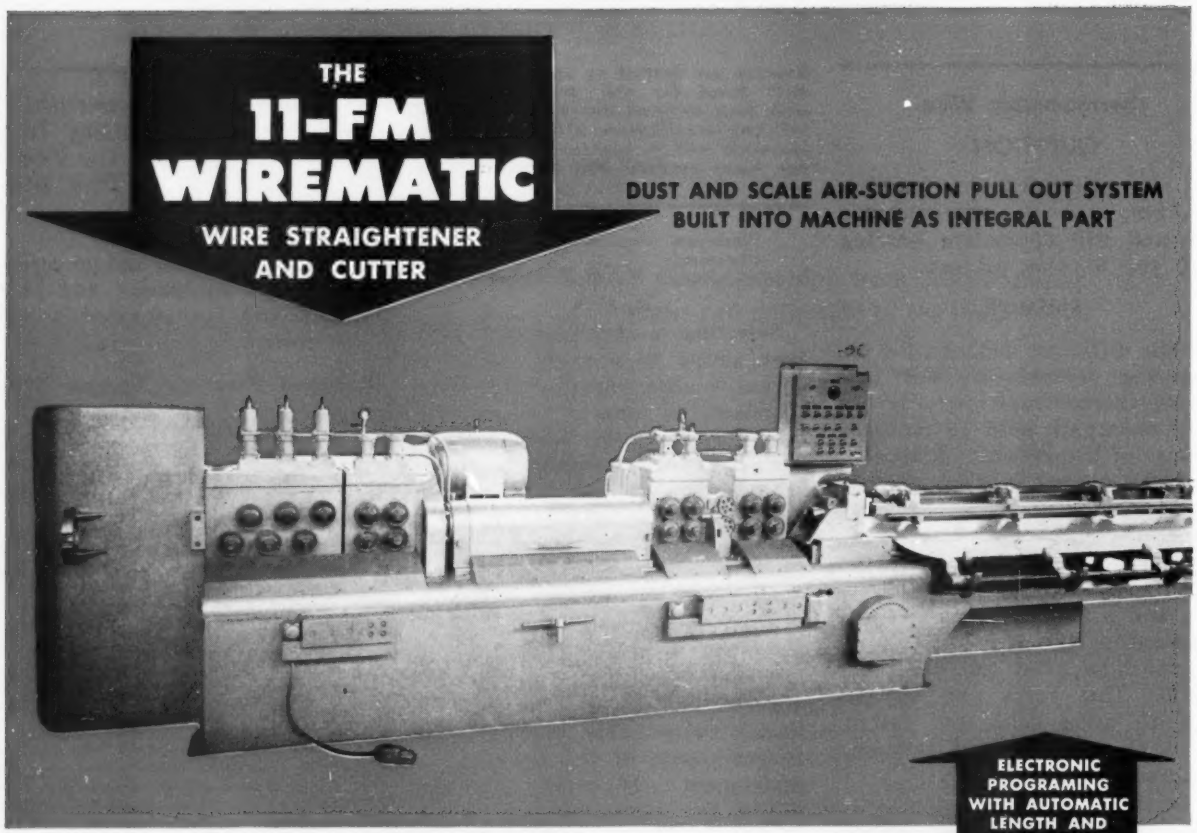
It has been said that the diamonds should be large enough to permit of 8 or so recuttings and a few complaints have been heard that some dies have been of such small size, as to the stone in relation to the hole, that only one and sometimes no recutting is possible.

* * *

An article appearing in WIRE AND WIRE PRODUCTS of April, 1956, entitled "The Wear of Diamond Dies" primarily dealt with the drilling of diamonds with respect to crystal plane orientation.

The Wire Machinery MAN . . .

ANNOUNCES



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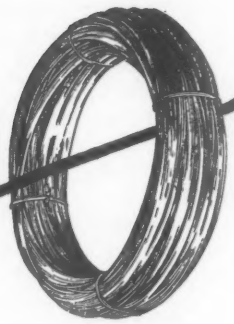

Being properly drilled in this manner is perhaps as important as size of stone, as it greatly increases die life.

* * *

Your point 2 may be covered in part by ASTM Spec. B 355-60T, which covers soft annealed nickel-coated copper wire. Tables covering tensiles and elongation are included. ASTM Spec. C 298–60 has similar information on silver-coated soft annealed copper wire. ASTM Spec. B 286–60T on copper conductors for hook-up and electronic equipment wire also adds some information of possible interest to you.

* * *

For Point 3 you are referred to ASTM Spec. B 228-56 and B 147-59 covering respectively stranded and bunched copper wire constructions. Weight, except in relation to resistances, is not stated.

ANSWER NO. 2

It is difficult to answer your first question in specific terms, as many factors are involved. For instance:

1) Type and amount of lubrication.
2) Proper inspection and replacement when needed.
3) Proper recutting when needed.
4) The type of wire drawn.

* * *

The care given a diamond die varies greatly from one wire mill to another and this greatly affects the number of recuts in a diamond die from mill to mill. Generally speaking, a diamond die will recut to double its original diameter. There are exceptions, for instance in larger sizes where a die may recut only two or three sizes, and in the smaller sizes where it may recut ten times or more its original diameter.

* * *

Another important factor considered extremely important is the manner in which the diamond is mounted and reinforced in metal. One diemaker has proven that the better the mounting the more recuts per die, all other factors being equal.

* * *

You must realize that this subject is a highly controversial one and we are not qualified to state that the above can be regarded as a hard and fast rule, and must stress again that the above mentioned factors vary from mill to mill.

Drawing Problems

QUESTION

We are having some difficulties in drawing wire and would appreciate your advice. We have a 5-hole slip type machine on which we use dies of the following diameters: 167″, 137″, .115″ and .087″. We feel that particles of steel may be becoming welded to the dies, marring the wire surface. Can you answer these questions?

1. Is this a practical drafting arrangement?
2. What is the best angle for ripper dies?
3. How often should the lubricant be changed in the ripper die box?
4. What entrance angles should be used and why?
5. What angle should the ripper die have if the intermediate dies have a 12° angle, and what ripper die angles are right if the intermediate dies have 16° to 20°?
6. What are the best angles for low carbon, medium carbon and high carbon wires?
7. Does a large angle on the ripper die put more lubricant on the wire?
8. Why is lime mixed with the lubricant?
9. Can water cooled dies adversely affect lubrication?
10. Is there a good reason for wrapping the wire with waste?

ANSWERS

1. You are using a 26½% reduction between the 3rd and 4th blocks and 29% between the 4th and finishing blocks. This will cause excessive slippage unless the machine is specially geared to these reductions and may be the cause of some of your troubles. Excessive slippage will cause an accumulation of slivers in the dies that will scratch the wire.

* * *

2. Probably about 20°, however some mills use 18° and 22° and a few use 24°.

* * *

3. When the drawing operation is working smoothly, the lubricant should not be changed, but added to as often as necessary to maintain an adequate supply. However, it should be stirred up frequently, as dirt may come off the wire and contaminate the lubricant. Stirring will make fresh soap available to be picked up.

* * *

4. A 16° angle is almost universally used — probably for 70% of the steel wire drawn. Ripper dies should have a larger angle, about 20°.

* * *

5. Ripper dies should have 16° to 18° if 12° are used on intermediate drafts and, if 16° to 20°

(*Please turn to page* 1595)

Enterprise Wire Announces Major Expansion

A new plant with production area for increased wire tonnage and equipment for the expansion of its line of wire products has been purchased by the **Enterprise Wire Company,** Blue Island, Ill., manufacturers of specialty wires, according to an announcement by **Richard K. Weyant,** President.

* * *

The Enterprise Wire Company began full-scale production in its 200,000 sq. ft. building at 2842 West Vermont Street on August 1, but production is being maintained at its Gregory Street plant until the transfer is completed.

* * *

An enlarged production area will permit increased wire and rolling mill output and the expansion of its straightening and cutting department. Additional tinning and galvanizing equipment will allow the coating of fine wire to 36 gauge.

* * *

To meet customer requirements for tonnage and product selection, new equipment has been installed in the Enterprise plant. It includes an annealing furnace with triple the present capacity, a patenting line, a number of new coarse wire drawing machines for producing sizes to ½" diameters, and facilities for drawing high carbon specialty wires.

* * *

Among the new products being added to the Enterprise line are cold heading wire (hard drawn, annealed in process and recessed head grades), high carbon specialties such as rope wire, metal stitching wire, and belt lacer wire. Additional facilities will be added for the production of special shaped wires. Metallurgical laboratories have been expanded to provide for new equipment and personnel.

Enterprise Wire's New Plant * * * *

* * *

Wire Engineering Associates, Inc., a division of Enterprise Wire Company, builders of custom and standard wire equipment, have also moved into the new plant facility. Business of both divisions now is being conducted from the new location.

* * *

The Enterprise Wire Company was incorporated on March 1, 1948, and began production in a garage with one machine. In the 13-year period that followed, the organization moved to larger quarters and enlarged its facilities on four occasions.

New Larger Capacity Fenn Hydroformer

Size capacity has been doubled over former models with the new 3H Hydroformer built by **Fenn Manufacturing Company,** Newing-

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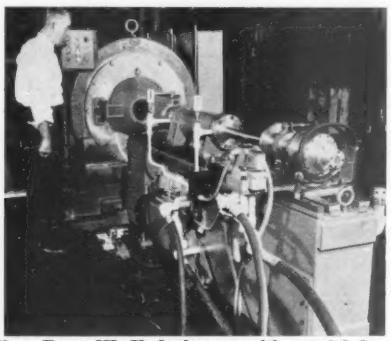
ton, Conn. Fittings up to 1-5/8" diameter now can be swaged for attachment to cable or flexible hose.

* * *

A modified type of rotary swaging machine, the Hydroformer permits the insertion and withdrawal of work pieces so they can be swaged between shoulders. The Fenn machine can also be used as a conventional rotary swager. Besides attaching fittings to cables or flexible hose, hydroformers are used to produce convoluted semi-flexible tubes, or convoluted tubing for a variety of purposes.

* * *

The 3H Hydroformer when used as a rotary swager, will form



New Fenn 3H Hydroformer with special hydraulic feed.

nonferrous light wall tubing up to 4-½" diameter and low tensile strength solid stock up to 2-1/4" diameter. To support the heavy loads imposed upon it, the new Hydroformer has a one piece meehanite frame backing up the elements of the hydroformer. The spindle housing is an integral part of the frame to insure proper alignment of the spindle and the other elements.

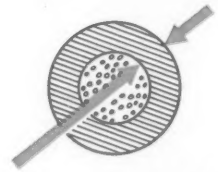
* * *

The photo illustrates the Fenn 3H Hydroformer with automatic feed equipment designed especially for feeding cable to which fittings are attached.

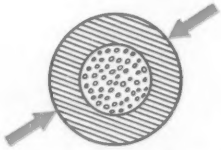
Large Reel for Strand Developed

Bethlehem Steel Company engineers at Williamsport, Pa., have developed a new dual-length reel that holds twice as much 7-wire stress-relieved strand as

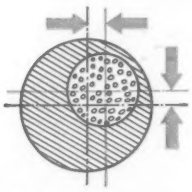
CABLEMAKERS



WALL THICKNESS
Monitoring or Control of Mean Wall Thickness



DIAMETER
Optical or Contact Monitoring or Control, Single or Dual Plane



ECCENTRICITY
Monitoring or Control of Coaxial and Multicore Cables and Jackets

INSULATION
Non-Contact Spark Testing
Corona Scanning Tests

PREHEATING
Monitoring or Control of Wire Temperature

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COST
LABOR
WITH

ADDISON ELECTRIC

INSTRUMENTATION

THE MOST ADVANCED–MOST COMPLETE–MOST VERSATILE

Addison instrumentation is used in over 200 Cable Plants throughout the world to obtain improvement in quality, increased rate of production, saving in labour and supervisory costs, and saving in raw materials. The equipments cover every aspect of cable manufacturing processes and the unitized construction affords exceptional versatility in building control systems to meet all requirements, at a very moderate cost.

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EXAMPLE
FIREPLACE CURTAIN SCREEN WIRE

The beauty and smooth operation of fireplace curtain screens depend on accurate forming, even spacing, and neat appearance of the mesh. The wire used must be of correct temper, diameter and finish. Uniformity of these properties is of prime importance. Leading fireplace equipment makers choose Continental Wire because it possesses these features dependably, in coil after coil. The ability to take intricate forming is an important reason why Continental Wire is specified for scores and scores of other products made with wire. Continental Curtain Screen wire, 19 gauge through 20 gauge inclusive in size, is available in 500 pound to 650 pound catchweight single length coils packed in Leverpac Drums for faster weaving with less down time, cleaner handling and better storage. For wire in practically any size, finish, temper or analysis, in low or medium low carbon steels, see Continental first!

Fine Finishes in Manufacturers' Wire

CONTINENTAL STEEL
CORPORATION

KOKOMO • INDIANA

PRODUCERS OF: Manufacturers' Wire in many sizes, tempers and finishes, including Galvanized, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, Liquor Finished, Bright and special shaped wire. Also Welded Wire Reinforcing Fabric Nails, Continental Chain Link Fence, and other products.

the standard reel. Yet the changes in dimensions are so small that the new reel will fit existing reel stands. Because one reel now takes the place of two, storage space requirements are reduced. With doubled capacity,

reels need be changed only half as often. Thus, handling costs are substantially lowered. An unusual splice between the two reel lengths develops the full strength of the strand.

New Shape S & C Machine

The Lewis Machine Co., 3441 East 76th St., Cleveland 27, Ohio, has added another new model for shapes to their line of wire straightening and cutting machines.

* * *

This model, the No. 21-FHA Travel-Cut Shape Straightening and Cutting Machine, has a capacity of 5/16″ to 13/16″ square or hex mild steel or equivalent area in shapes and flats up to 2″ wide.

* * *

The outstanding features of this newly designed model are the improved low-inertia flying-shear cut-off and a simplified electric trip mechanism independent of the gauging mechanism making possible much higher production.

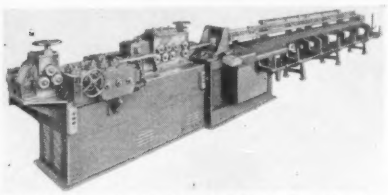
* * *

The machine is designed to take the stock from the coil, straighten and cut automatically to accurate predetermined length.

* * *

The Straightener consists of a three-roll Preliminary Straight-

ener which breaks the coil bow, an eight-roll Horizontal Straightener for edge straightening, and an eight-roll Vertical Straightener for finish straightening. All roll shafts are power-driven and mounted on roller bearings. The entire Horizontal Straightener Housing is adjustable in the horizontal plane to compensate for various stock width. The upper rolls in the Vertical Housings and the front rolls in the Horizontal Housing are individually



21-FHA Travel-Cut Shape Straightening Machine

adjustable for proper roll pressure and offset.

* * *

The Cutoff is the newly designed high-speed Travel-Cut flying-shear type which travels with the rod and cuts while in motion. A single crank-driven lever provides both the longitudinal travel and the vertical cutting stroke and eliminates all cams, springs and loose links; thereby assuring positive and accurate cutoff action without the high inertia and shock of conventional mechanisms. A Reeves Variable Speed Motodrive independently drives the flywheel and cutoff and permits accurate synchronization of the cutoff head speed with the feed speed, thus making possible the elimination of feed roll marks on the rod. An Air Clutch and Brake assures fast, positive and smooth engagement and reduces maintenance to a minimum.

Scott Elongation Tester

A special tester designated Model XE-5 is being offered by **Scott Testers, Inc.** of Providence, R. I., specifically for determining elongation of copper wire.

* * *

Model XE-5 Elongation Tester is used extensively by leading

For Moisture Resistance, Specify

TEXTILENE

TWI-FLEX and TWI-WAX

Treated to reduce wicking and prevent leaching, lightly waxed Textilene Twi-Flex and heavily waxed Textilene Twi-Wax provide effective resistance to moisture. Both fillers are extensively employed for non-metallic sheathed cable (building wire), maritime shipboard cable, varnished cambric cable, and underground service entrance cable.

Twitchell's superior Textilene line also includes: Soft, dry fillers — *Twi-Port* and *Glascor** (Fiberglas-centered for high tensile strength without added bulk). Used for control, power, appliance, coaxial and communications cables, and all portable and flexible cords.

Fungus-resistant filler — *Twi-Tar.* Used for buried communications cable, expanded ACSR cable, and in other applications.

*Patent Applied For

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

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Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation — also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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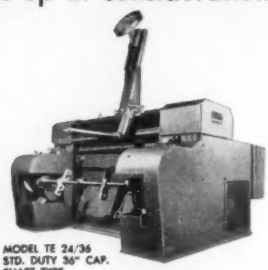
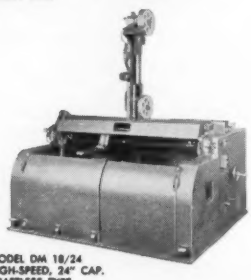
Package deals imply certain guarantees and seem initially convenient but your ultimate convenience is best assured when you select an extruder take-up in consideration of its own individual merits.

ENTWISTLE Take-Ups are designed and built to stand out in comparisons and performance depends solely on the constant flow of insulated wire from the extrusion system.

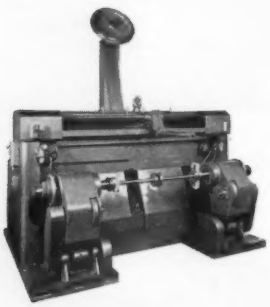
No wonder why the discerning Wire and Cable Engineer complements his extruder with a selected ENTWISTLE Take-Up.



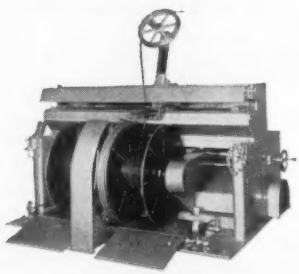
MODEL TE 24/36
STD. DUTY 36" CAP.
SHAFT TYPE



MODEL DM 18/24
HIGH-SPEED, 24" CAP.
SHAFTLESS TYPE



MODEL THE 24/36
HEAVY DUTY, 36" CAP.
SHAFT TYPE



MODEL DM 24/36
HIGH-SPEED, 36" CAP.
SHAFTLESS TYPE

Over 40 years of dependable service

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Formerly James L. Entwistle Co.

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British Associates	THE KEMSON ENGINEERING CO., LTD.	Blackburn, Lancs., England

wire manufacturers to determine the suitability of copper conductor wire for stranding. It can also be used to obtain an economical evaluation fast and accurately of any similar material where elongation is the prime consideration.

Scott Testers XE-5 Elongation Tester

* *

The Model XE-5 is equipped with Scott Wedge Wire Clamps, permitting rapid inserting and removal of test specimens. Elongation is indicated by an easy-to-read five foot steel tape. Clamp separation is at the rate of 12" per minute. The tester may be arranged either for wall mounting or furnished with a floor stand (as shown in photo).

* * *

Complete details on Scott Model XE-5 Elongation Tester may be obtained by writing Scott Testers, Inc., 55 Blackstone Street, Providence, R. I.

Indiana Wire Die Company

One of today's fastest growing diamond die manufacturers is **Indiana Wire Die Co.**, located in the "diamond die center", Fort Wayne, Indiana.

The industry, unlike metal-working industries with their automated production lines, relies more on individual craftsmanship to produce the precision dies which are used to draw wires as fine as .0003″ in diameter.

* * *

The knowledge and skills required are usually acquired on the job rather than by more formal educational methods. The history of Indiana Wire Die is typical of the development of a manufacturing unit in the industry.

* * *

In 1941, **Otis G. Ferrier,** who had formerly been employed as a diemaker at Fort Wayne's Dudlo Mfg. Co., and then in a die manufacturing plant, purchased the business and registered the proprietorship as Indiana Wire Die Co.

* * *

Improvements in machinery and methods during the years following enabled the Company to produce dies of closer tolerances and increase productivity to maintain prices which greatly expanded the volume of business.

* * *

Included in such developments at Indiana are special drilling machines built and used only there, and a unique method of mounting diamonds in the die cases.

* * *

In 1959, Mr. Ferrier went into semi-retirement and his son **Dale O. Ferrier** became general manager. In 1960, to provide for expanding demand for its product, the firm opened a branch at Fayette, Alabama, the **Alabama Wire Die Co.**

Get the habit of reading

regularly

WIRE AND WIRE PRODUCTS

The Wire Man's Magazine

no worry!

Even if those Apco Mossberg Reels do fall, they won't be damaged because of their all-steel construction. They're designed and manufactured to close tolerances too, so you will have no worries about breakage, tapping or wire waste.

With Apco Mossberg Reels and Spools, machine downtime and maintenance are at a minimum.

Fifty years of experience behind these reels assure smooth spool-out at high speeds. For additional information, write, wire or call collect.

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Ferry Building
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CANADIAN REPRESENTATIVE:
Hugh P. Williams & Co.
47 Colbourne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

Outstanding Personalities of the Wire Industry

Keystone Appointments

Keystone Steel & Wire Company has announced the appointment of **Jerry G. Weiss,** who had been assistant superintendent of the wire mill, to the newly created position of Director, Wire Mill Development.

* * *

The company also has promoted **Earl Langenberg** to Chief Engineer and **John Buehter** to Assistant Chief Engineer.

Ray Worth in New Post

Raymond S. Worth, who had been Manufacturing Manager of the John A. Roebling's Sons Division of The Colorado Fuel & Iron Corporation's Wire Mills Division in Roebling, N. J., for the last ten years, has been appointed Works Manager of the Corporation's Wickwire Spencer Steel Division in Buffalo, N. Y. The appointment became effective as of October 1, 1961.

* * *

Mr. Worth, a long-time member and director of The Wire Association, has served in many official capacities in Association work and was elected President of the society in October, 1960. Currently he will divide his time between Buffalo and Roebling until his successor can be fully integrated in his new duties.

RAYMOND S. WORTH

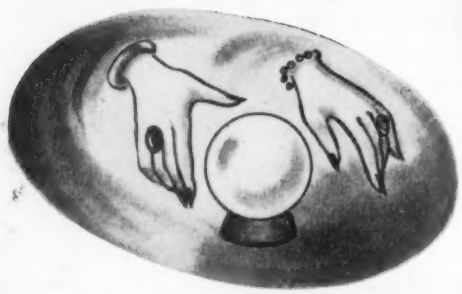
Blane Appoints Trykowski and Levin to Key Positions

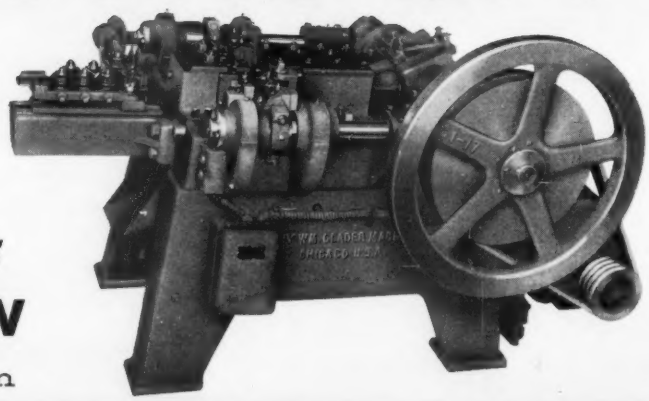
The appointments of **Stanley J. Trykowski** as Technical Director and **Sumner Levin** as Manager of Plant Operations, have been announced by **Joseph Neipris,** President, **The Blane Corporation,** Canton, Mass., manufacturer of vinyl and polyethylene compounds and color concentrates.

* * *

Mr. Trykowski brings 11 years of experience in the research and development of vinyls for the wire and cable industry. Prior to joining Blane, he was Technical Director of Electronic Rubber and Plastics Corporation of Stamford, Conn. Previously, he was Assistant to the

IF THERE'S A NAIL MACHINE IN YOUR Future make it a GLADER





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Write for 12 Page Bulletin

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EXPORT DEPT. 122 EAST 42ND STREET • NEW YORK 17, N. Y.

Stanley J. Trykowski

Director of Research and Development of William Brand & Co., a wire and cable manufacturer.

C F & I Appoints

The Board of Directors of **The Colorado Fuel and Iron Corporation** has elected **R. L. Hanes** as vice president in charge of sales of the Western Division of CF&I and **E. George Hartmann** as vice president in charge of sales of the Wickwire Spencer Steel and John A. Roebling's Sons Divisions, it was announced by **Alwin F. Franz,** president.

* * *

Mr. Hanes had been serving as general manager of tubular sales since 1960. Prior to that he had been assistant to the vice president of sales. He has been associated with CF&I for 32 years and has held executive sales positions in the Corporation's general sales offices in Denver and in district offices.

* * *

Mr. Hartmann had been serving as vice president of sales of the John A. Roebling's Sons Division of CF&I since 1958. He joined the John A. Roebling's Son's Company in 1940 as assistant sales manager. Prior to joining Roebling, Mr. Hartmann was associated with the Wickwire Steel Company. He has had 43 years experience in the wire and wire products industry.

John P. Zur

Sunbeam Appoints Three To Engineering Posts

Three engineering appointments for **Sunbeam Equipment Corporation,** Meadville, Pa., have been announced by **Vincent R. Troglione,** President. **John P. Zur** was appointed Vice President of Engineering; **Willard Roth,** Engineering Manager; and **Norman J. Acker,** Assistant Engineering Manager. Mr. Zur had

Marking Machines, Wheels & Inks

FOR INSULATED WIRE, TUBING AND PIPE—

Type AM — Illustrated has these features:

1. Use present towers, no changes necessary.
2. One filling of ink well, gives 18 HOURS of continuous simulated spiral striping, number coding or printing.
3. For single or double marking or hash mark striping.
4. Constant wiper pressure.
5. Diam. range .032 thru 1½".

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West Coast Representative: Paul I. Kenner Co., 230 Shaw Rd., So. San Francisco, Calif.
West Germany: Walter G. Fritzke GMBH, AM Wehrhahn 94-96, Dusseldorf, W. Germany
Warbrick Engineering Specialties Limited, Barclays Bank Chambers, Sanky Street, Warrington, England.

been Chief Engineer, Mr. Roth was Assistant Chief Engineer, and Mr. Acker previously was president of Mern Industries.

* * *

Mr. Zur is a member of American Society for Metals, The Wire Association and is a registered professional engineer in the state of Ohio.

Union Carbide Plastics Appointments

Douglas L. Peterson, Technical Sales Representative, has been transferred from the North Central Sales Region to the South Atlantic Region of **Union Carbide Plastics Company,** Division of Union Carbide Corp., **V. L. Larson,** Regional Sales Manager, has announced. He will be located in the Company's Moorestown, N.J., Regional Sales Office at Pleasant Valley Road and Route 38. He is a 1959 graduate of Lehigh University.

* * *

John R. Peterson has been named Office Manager of the Cleveland District Sales Office according to the announcement by **J. M. Herbert,** Sales Manager — North Central Region.

* * *

In this position, he will be responsible for the direction of all office functions at 1300 Lakeside Avenue, N.E., Cleveland 14. He is a 1955 graduate of Hunter College.

* * *

Richard A. Daily, Technical Representative, has been transferred from the South Atlantic Sales Region to the Minneapolis, Minn., Sales Office, according to an announcement by **H. L. Burpo,** Mid-Western Regional Sales Manager. He will be located at the Company's District Sales Office at 4010 West 65th Street, Minneapolis 24, Minnesota (WAlnut 7-8835). He is a 1955 graduate of Princeton University.

Heads Screening Bureau

The newly elected president of the **Insect Wire Screening Bureau** is **Stuart M. Jones,** executive vice president of **New York Wire Cloth Co.,** York, Pa. Mr. Jones was elected at the recent Bureau's membership meeting held in New York City.

* * *

Elected Vice President was **E. B. Frock,** who is vice president of **Hanover Wire Cloth Company,** Hanover, Pa.

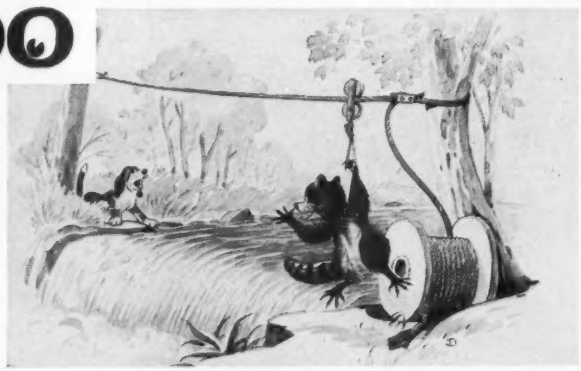
* * *

The Insect Wire Screening Bureau is a national trade association consisting of the major weavers of metal insect wire screening.

* * *

Mr. Jones has long been prominent in the wire screening industry, having spent more than 30 years in it. He has held many important government positions including that of consultant on wire cloth production to the War Production Board from 1942 through 1945 and Chairman of the U. S. Department of Commerce Committee on Com-

CREWE'S ZOO



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Reduce costs by lowering metallic cross sectional area through use of Moly lubricated, Hi-torsion, ultra strength stainless aircraft and rope wire. Maryland Fine Wire is also a dependable source for stainless wires listed below.

MARYLAND FINE STAINLESS WIRE

Aircraft Cord	Heddle	Reed
Braiding	Hook & Eye	Rope
Brush	Hose Reinforcing	Sponge
Ceiling	Knitting	Spring
Cold Heading	Lashing	Weaving
Fish Leader	Nail	Welding
Flexible Shaft	Pin	
Forming	Redraw	

When you need any of these wires you need Maryland Fine quality and service.

Wire PHONE OR WRITE

NOrmandy 6-2500

MARYLAND FINE & SPECIALTY *Wire* CO., INC.

MAIN OFFICE AND PLANT • COCKEYSVILLE, MARYLAND

mercial Standards for Insect Wire Screening. His most recent appointment was to the Executive Reserve of the Business and Defense Services Administration.

Named Assistant Director of Technical Information for Climax Molybdenum

The appointment of **Barry Crowston** as Assistant Director of Technical Information for **Climax Molybdenum Company**, a division of American Metal Climax, Inc., has been announced by **Reuel E. Warriner**, Climax Vice President.

* * *

As assistant to **Dr. J. Z. Briggs**, Director of Technical Information, Mr. Crowston will work principally on the preparation of publications concerning molybdenum and its uses.

* * *

Prior to his association with Climax, Mr. Crowston worked for four years as an apprentice metallurgist at the Appleby-Frodingham branch of United Steel Companies in Scunthorpe, England. Following this he attended the University of Nottingham and graduated with honors, receiving a B.Sc. in Metallurgy.

Appointment by Anaconda Amer. Brass

Henry C. Cornell has been appointed adminstrative manager of the Waterbury Division of Anaconda American Brass Co. Mr. Cornell, who has held a similar position at the Waterbury Division, will replace **George C. Hanley**, who has been appointed assistant secretary of the company.

Firth Sterling Elects New Director

Firth Sterling Inc. announces the election of **Joseph C. Abeles**, President, Kawecki Chemical Company, Boyertown, Pa., to the board of directors of the Company. Mr. Abeles succeeds **Dr. Paul F. Genachte,** now Vice President, International Department, The Chase Manhattan Bank, New York City.

Elected Vice Pres.-Ops. by Triangle

Harry H. Martin, former Director of Purchases and Transportation for **Sylvania Electric Products, Inc.,** has been appointed Vice President of Operations by **Triangle Conduit & Cable Company's** President, **Carl S. Menger.**

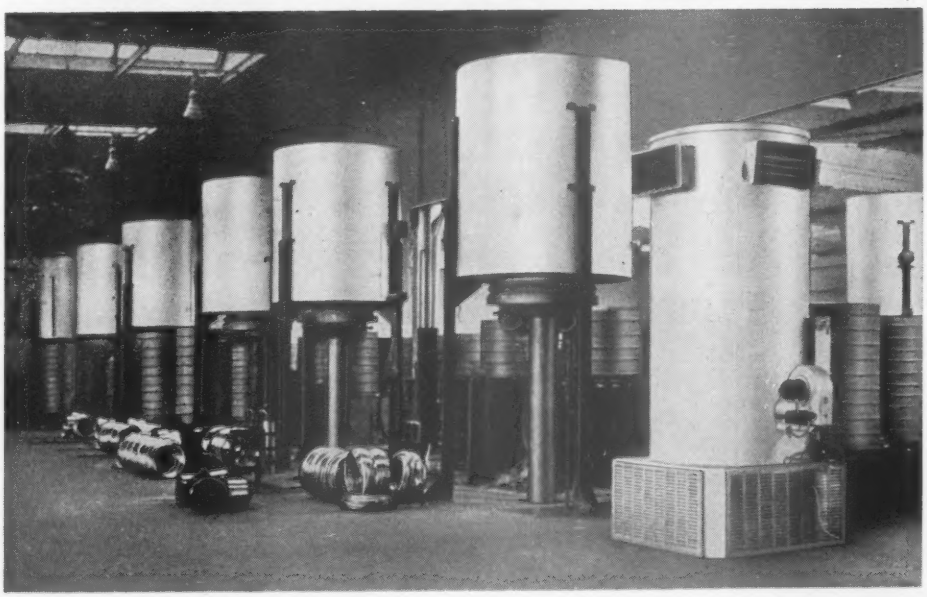
* * *

In this position, Mr. Martin will report directly to the President and will assume responsibility for the administration of all the manufacturing operations of the company, as well as the key related functions of Purchasing, Industrial Engineering, Industrial Relations, Traffic and Warehouse Management.

* * *

He studied electrical engineering at Drexel Institute of Tech-

Now also for Stainless and Chrome-Nickel!



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WRITE TO: FRITZ INDUSTRIAL FURNACES HAGEN, P. O. B. 448 (W.-GERMANY)

nology in Philadelphia and has had extensive experience in the purchasing and manufacturing fields.

* * *

Before joining Sylvania, he was an industrial engineer with Radio Corporation of America in Camden, N. J., and later was manufacturing superintendent and purchasing agent of H. H. Brown Co., Worcester, Mass.

* * *

He joined Sylvania in 1948 as purchasing agent for its subsidiary, Colonial Radio Corp., in Buffalo, N. Y. In 1953, Mr. Martin was named manufacturing manager of Buffalo operations and in 1954 became responsible for all manufacturing operations of the Home Electronics Division of Sylvania with headquarters in Batavia, N.Y.

* * *

He was general manufacturing manager of all purchasing and production for the division in early 1960 when he was named Director of Purchases with headquarters in New York City, where he was responsible for the co-ordination of purchases by Sylvania's nine divisions.

* * *

He is married to the former Jean Anne Leslie of Clinton, Mass., has three children, William - 25, Bonnie - 24 and Beverly - 20, and now resides at 39B Troy Drive, Springfield, N. J.

General Manager of Smith Thermotronics

Smith Thermotronics, Inc., Conshohocken, Pa., manufacturers of thermocouple temperature sensing elements and accessories, has announced the appointment of **Robert L. Dyer** as new General Manager. He is an engineering graduate of Lehigh University and studied at Temple University, Penn State, and Neff College.

Appointments at Rylands (Aust.)

B. A. Moylan has been appointed production planning superintendent at **Rylands Bros. (Aust.) Pty. Ltd.** He started with Rylands Bros. (Newcastle), in 1938 as a technical trainee, and gained a Metallurgy Diploma at the Newcastle Technical College. After experience in the technical department, he was transferred to the production department where he has had considerable experience in programme planning.

* * *

R. Guy has been appointed wire mill superintentent at Rylands Bros. (Aust.) Pty. Ltd. After commencing with Rylands Bros. (Newcastle) as a junior labourer in the netting miscellaneous department, Mr. Guy was appointed a leading hand.

* * *

He enrolled at the Newcastle Technical College, and made such progress in the Metallurgy Diploma Course that he was at-

---

AMERICAN IRON AND STEEL INSTITUTE
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AIS 10

SHIPMENTS OF STEEL PRODUCTS
ALL GRADES INCLUDING CARBON, ALLOY AND STAINLESS
(NET TONS)

JUNE - 1961
Month

Covering Net Shipments (Excluding Shipments to Members of the Industry for Conversion into Further Finished Products or for Resale)

STEEL PRODUCTS		CURRENT MONTH 1961					Prior Year (1960)	YEAR TO DATE * 1961					Prior Year (1960)
		CARBON	ALLOY	STAINLESS	TOTAL	Percent of Total Shipments	Percent of Total Shipments	CARBON	ALLOY	STAINLESS	TOTAL	Percent of Total Shipments	Percent of Total Shipments
Ingots and steel castings	1A	8,869	8,919	477	18,265	0.3	0.4	54,046	52,731	1,908	108,685	0.3	0.5
Blooms, slabs, billets, sheet bars	1B	76,384	36,487	3,241	116,112	1.9	1.8	345,693	172,317	15,821	533,831	1.7	2.1
Tube rounds	1C	966	961	-	1,927	-	-	4,925	3,976	27	8,928	-	-
Skelp	2	1,761	-	-	1,761	-	0.1	53,698	-	-	53,698	0.2	0.2
Wire rods	3	78,391	2,970	1,523	82,884	1.4	0.9	412,140	10,831	5,461	428,432	1.4	1.3
Total Semi-Finished		166,371	49,337	5,241	220,949	3.6	3.2	870,502	239,855	23,217	1,133,574	3.6	4.1
Bars-Hot rolled(incl. light shapes)	14	445,921	126,579	3,733	576,233	9.4	8.1	2,293,936	615,214	20,561	2,929,711	9.4	10.1
Bars-Reinforcing	15	238,034	-	-	238,034	3.9	3.6	1,166,155	208	-	1,166,363	3.7	2.4
Bars-Cold finished	16	85,372	17,332	4,950	107,654	1.8	1.8	443,681	82,611	27,484	553,776	1.8	2.1
Tool steel	17	658	6,254	-	6,912	0.1	0.1	3,612	35,162	-	38,774	0.1	0.1
Total Bars and Tool Steel		769,985	150,165	8,683	928,833	15.2	13.6	3,907,384	733,195	48,045	4,688,624	15.0	14.7
Wire-Drawn	23	228,971	3,428	2,161	234,560	3.8	2.8	1,133,519	16,256	11,103	1,160,878	3.7	3.1
Wire-Nails and staples	24	31,479	-	2	31,481	0.5	0.4	171,969	-	4	171,973	0.6	0.4
Wire-Barbed and twisted	25	6,997	-	-	6,997	0.1	0.1	44,226	-	1	44,227	0.1	0.1
Wire-Woven wire fence	26	13,086	-	-	13,086	0.2	0.2	81,482	-	-	81,482	0.3	0.2
Wire-Bale ties and baling wire	27	12,606	-	-	12,606	0.2	0.1	43,439	-	-	43,439	0.1	0.1
Total Wire and Wire Products		293,139	3,428	2,163	298,730	4.8	3.6	1,474,635	16,256	11,108	1,501,999	4.8	3.9
Black plate	28	45,851	-	-	45,851	0.8	0.9	266,647	-	-	266,647	0.9	0.8
Tin and terne plate-Hot dipped	29	30,001	-	-	30,001	0.5	0.9	153,870	-	-	153,870	0.5	0.5
Tin plate-Electrolytic	30	528,700	-	-	528,700	8.6	9.3	2,881,987	-	-	2,881,987	9.2	6.9
Total Tin Mill Products		604,552	-	-	604,552	9.9	11.1	3,302,504	-	-	3,302,504	10.6	8.2
Sheets-Hot rolled	31	632,809	15,557	1,562	649,928	10.6	9.8	3,157,100	84,529	7,940	3,249,569	10.4	11.5
Sheets-Cold rolled	32	1,062,339	2,833	13,377	1,078,549	17.6	22.3	5,455,460	17,692	71,518	5,544,670	17.8	20.3
Sheets-Galvanized	33	302,345	-	-	302,345	4.9	4.7	1,503,027	107	-	1,503,134	4.8	4.2
Sheets-All other metallic coated	34	19,723	-	-	19,723	0.3	0.3	101,717	-	-	101,717	0.3	0.3
Electrical sheets and strip	35	1,984	43,694	-	45,678	0.8	0.8	9,452	250,878	-	260,330	0.8	0.8
Strip-Hot rolled	36	103,552	2,056	1,016	106,624	1.7	1.5	520,994	8,467	2,945	532,406	1.7	1.9
Strip-Cold rolled	37	99,984	2,031	14,189	116,204	1.9	1.5	487,022	8,773	76,596	572,691	1.9	1.9
Total Sheets and Strip		2,222,736	66,171	30,144	2,319,051	37.8	40.9	11,234,772	370,446	159,299	11,764,517	37.7	40.9
Total Shipments (1961)		5,721,685	361,100	50,734	6,133,519	100.0	xxx	29,099,930	1,857,148	270,920	31,227,998	100.0	xxx
Total-Prior Year (1960)		5,552,302	323,201	45,357	5,920,860	xxx	100.0	39,783,965	2,739,069	330,903	42,853,937	xxx	100.0

* Revised

8261

tached to the staff training scheme. After gaining his Diploma he worked with the technical, efficiency and production departments, and eventually in 1956 was transferred to the Geelong Works as mill foreman.

Winds Association Clock for 1962

On October 16, 1961, Mr. C. F. **Brereton,** Chief Metallurgist of **Richard, Johnson & Nephew, Ltd.,** Manchester, England, called at the headquarters of **The Wire Association** in Stamford, Connecticut, to wind the clock presented to the Association at an Annual Convention held in Pittsburgh, Pennsylvania, in 1948 by **John Rigby,** Director of **John Rigby & Sons, Ltd.,** of Bradford, England, on behalf of our British members.

* * *

The clock, a handsome grandfather type, is wound each year by one of our members from England, Mr. Brereton being the thirteenth man from Great Britain to perform this traditional and pleasant ceremony. The clock will run for 400 days after being wound.

* * *

Mr. Brereton was accompanied by Mr. **Eric Ogden** of the same company, who handles export sales. Both men, after attending to some private business interests here, flew on to French Lick, Indiana, for the thirty-second Annual Convention of the Association, after which they took off for the return trip to their homeland. Their firm is one of England's leading producers of wire.

Mr. Brereton winding the Association Clock for 1962.

* * *

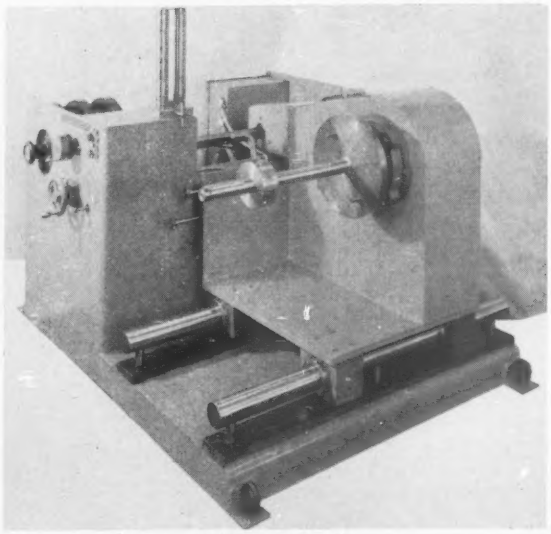
The Association is indebted to these gentlemen for their kindness in taking the time out of their busy schedule to come to Stamford to see that the clock was properly prepared for another year of highly accurate timekeeping and their courtesy is appreciated.

* * *

Mr. Brereton conveyed greetings to **Richard E. Brown,** Executive Secretary, from **John Rigby** and all of the other Association members of England.

THE BUYERS' GUIDE will help you locate sources of supply.

REEL TRAVERSING TAKE-UP NO. 1271



AIMCO Take-Up

USED BEHIND TAPING MACHINES OR OTHER PROCESSING MACHINES FOR SQUARE OR FLAT WIRE. REEL SIZES UP TO 30" OD, 11" TRAVERSE.

ADJUSTABLE STALLED AND RUNNING TENSION.

EST. 1855 AIMco INC. 1915

"American" AIMCO INSULATING MACHINERY COMPANY

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FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting $1.00 for each copy desired. For orders received from outside the United States the cost will be $1.50 per copy.

For copies of patents that are out of print in the Patent Office, necessitating a reprint, the charge for U.S.A. orders is $1.50 and for foreign orders, $2.50 per copy.

No. 2,994,441, DISPLAY RACK, patented August 1, 1961 by Wayne Ferris Browning, Jr., Avondale Estates, Ga., assignor to Southern Spring Bed Co., a corporation of Georgia.

A three-sides upwardly-extending wire rack is disclosed. There are 12 claims.

* * *

No. 2,994,623, INSULATED ELECTRICAL CONDUCTOR AND METHOD OF MAKING THE SAME, patented August 1, 1961 by Robert Saxon, Stamford, Conn., assignor to American Cyanamid Company, New York, N. Y., a corporation of Maine.

Surrounding the wire conductor is an insulating coating comprising a ternary polymer of acrylonitrile, a vinylpyridine and a third different monoethylenically unsaturated material, such as vinyl acetate. There are 14 claims.

* * *

No. 2,994,624, WIRE COATING APPARATUS AND METHOD, patented August 1, 1961 by Harry B. Lit, Pittsfield, and Richard P. Anderson, Cheshire, Mass., assignors to General Electric Company, a corporation of New York.

Wire having at least one flat side is uniformly coated by applying a hardenable liquid coating material on the wire, passing the wire with its flat side in engagement with a wiping surface having a recess formed therein so that all of the coating material is removed except that passing through this recess, hardening coating material remaining on the flat side so as to form a solid ridge of coating thereon, applying hardenable liquid coating material around the wire in sufficient amount to provide, on the remainder of the wire surface, a coating having a thickness at least equal to the height of the ridge, and hardening the thus applied material.

* * *

No. 2,994,945, PROCESS FOR WIRE-WOUND RESISTOR, patented August 8, 1961 by Robert V. Cahill, Catskill, N. Y., assignor to Sprague Electric Company, North Adams, Mass., a corporation of Massachusetts.

A technique for connecting terminals to vitreous enamel-coated wire-wound resistors is disclosed, convenient for mounting on an electrical chassis without need for additional mounting hardware.

* * *

No. 2,995,057, SEAL FOR RIGID SEATING MEMBERS WHEREIN PROTRUDING PORTION THEREOF IS RECEIVABLE INTO ADJACENT CHANNEL PORTION, patented August 8, 1961 by Joseph F. Nenzell, Culver City, Calif., assignor to Parker-Hannifin Corporation, a corporation of Ohio.

More specifically, a self-sealing screw for use in a countersunk opening and associated with a deformable packing is provided, the screw having an annular groove of generally triangular cross-section into which the packing extends.

* * *

No. 2,995,155, WIRE BENDING DIE MECHANISM, patented August 8, 1961 by Andrew Jay Fisher, Jr., Saginaw, Mich., assignor to Saginaw Wire Products, Inc., Bridgeport, Mich.

There are sixteen claims in this patent for a die assembly for use in a wire spring forming machine, including a first die on one side of the wire in one position displacing the wire from a longitudinal axis and a die on the opposite side removed rearwardly from the wire when the first die is in the position; a device for moving said latter die forwardly to move the die into engagement with the wire at a particular point from the position out of engagement therewith and through a generated non-circular arc so that the latter die folds a part of the wire transversely to its longitudinal extent around the first die with the latter die at the end of its travel forwardly contacting the wire at the same point it initially engaged it.

* * *

No. 2,995,157, MACHINE FOR HELICALLY BINDING BOOKS, patented August 8, 1961 by Vincenzo Catini, Newark, N. J., assignor to Spiral Binding Company, Inc., New York, N. Y., a corporation of New York.

Here is the difference between just any reel and MPS reels with
DURA CURL RIMS
Yes, it's the exclusive MPS heavy duty thickened-section rims that assure maximum strength and rigidity throughout the reel heads. Flange run-out and straightening expenses are eliminated by this patented MPS development. DURA-CURL rims are now standard on all MPS wire drawing, annealing, and stranding spools and reels. We invite your inquiries — let us tell you more about Dura-Curl rims.
MPS
trouble-free winding spools and reels
Mossberg PRESSED STEEL Corporation
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DIVISION OF WANSKUCK CO.
TEL CAstle 2-0347
No. 107

A helically wound wire binder is formed from a wire supply by the machine and threaded into the binding edge portion of the book. There are 10 claims.

* * *

No. 2,995,648, SPRING COILING APPARATUS, patented August 8, 1961 by Robert Garnett Heal, St. Margarets-on-Thames, England, assignor to Staples & Company Limited, London, England, a British company.

Included is a heater disposed between a wire coiling mechanism and a coiled wire severing guillotine adapted to heat a constant length of the moving coil after it has been formed and has issued from the coiling mechanism.

* * *

No. 2,996,000, AIR-OPERATED WIRE AND TUBE MARKING MACHINE, patented August 15, 1961 by Lewis A. Kingsley, Beverly Hills, Calif. (c/o Kingsley Stamping Machine Co., 850 Cahuenga Blvd., Hollywood 28, Calif.)

More specifically this is a hot stamping machine operated pneumatically to reciprocate the stamping mechanism with a control to effect repeated contact of the stamping mechanism with the wires in the same area for intervals insufficient to detrimentally affect the wire.

* * *

No. 2,996,087, WIRE-FORMING MACHINE, patented August 15, 1961 by Lee O. Gates, Sr., 470 S. Bryant St., Denver, Colo.

The machine is adapted to form loops on lengths of wire. There are 15 claims.

* * *

No. 2,996,170, STORAGE TYPE WIRE DRAWING MACHINE, patented August 15, 1961 by Carl O. Bruestle, Metuchen, N. J., assignor to Syncro Machine Company, Perth Amboy, N. J., a corporation of New Jersey.

A multi-stage differential storage type wire drawing machine is disclosed, with the multiple die in tandem.

* * *

No. 2,996,265, WINDING SPOOL, patented August 15, 1961 by Frederick J. Bieber and Clarence I. Steinback, Minneapolis, Minn., assignors to Acrometal Products, Inc., Minneapolis, Minn., a corporation of Minnesota.

The spool is of the tubular type with double heads having inserted head joints.

* * *

No. 2,996,378, ELECTRICAL RESISTANCE WIRE, patented August 15, 1961 by Edward E. Edmunds, Shrewsbury, Arthur S. Lichter, Little Silver, and Stephen Poch, Wyckoff, N. J., assignors to Molecu-Wire Corporation, a corporation of New Jersey.

This nickel-base alloy wire is said to have a specific resistance of at least 800 ohms per cmf. and a temperature coefficient of resistivity of at most .00002 ohm per phm degree C. over a temperature range of from —85°F. to +482°F.

* * *

No. 2,996,734, SCREW SLOTTING MACHINE WITH ROTARY WORK CARRIER BRAKING MEANS, patented August 22, 1961 by Harry R. Lange, Waterbury, and Robert F. Mitchell, Watertown, Conn., assignors, by mesne assignments, to Textron, Inc., Providence, R. I., a corporation of Rhode Island.

The machine includes a dial hub rotatably mounted on a frame with a ringlike dial member carried by the hub and having radially-directed slots to receive screw blanks with their heads projecting radially from the dial, and a brake engaging the surface of the hub within the dial to frictionally resist rotation of the hub and dial.

* * *

No. 2,996,943, CARPENTRY SCREW, patented August 22, 1961 by Clyde C. Johnson, 10213 7th Ave., Inglewood 47, Calif.

The screw threads are spaced from the pilot end portion of the screw shank, which end portion is elongated and pointed and extends from a tapered shouldered, next adjacent the end of the screw threads.

* * *

No. 2,997,076, COIL WINDING MACHINE, patented August 22, 1961 by Charles F. McVoy, Jr., Danville, Ill., assignor to General Electric Company, a corporation of New York.

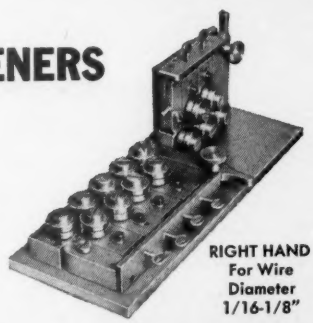
Before the wire to be coiled reaches the winding mechanism at least part of the wire is coated with an adhesive, but the wire is maintained, at predetermined times, out of contact with the adhesive by mechanism actuated by the winding mechanism. There are 27 claims.

* * *

No. 2,997,249, LAYING ARM FOR WIRE COILING DEVICE, patented August 22, 1961 by Gerhard Meinhausen, Rheinhausen, Germany, assignor to Huttenwerk Rheinhausen Aktiengesellschaft, Rheinhausen, Germany.

As the wire travels through a rotating curved laying arm constituting a guide for the wire, it moves in a specifically defined curved path detailed in the single claim.

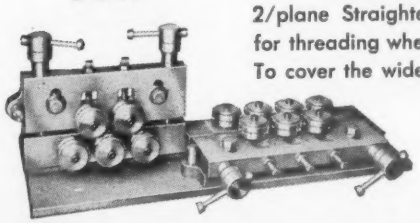
Sjogren 2 PLANE ROLL STRAIGHTENERS



RIGHT HAND
For Wire
Diameter
1/16-1/8"

Sjogren Two Plane Roll Straighteners are fully ball bearing for heavy production duty. They are designed to accommodate all sizes and grades of round or shaped wire whether it be high carbon, low carbon or copper, as well as the many alloys, from .010" to .375". Once set for the job at hand Sjogren 2/plane Straighteners may be opened and closed for threading when making coil changes without effecting the adjustment of the setting. To cover the wide range of wire diameters there are several size groups manufactured with either left or right hand direction. Each is individually produced to exact specifications for the grade, size and type of wire to be processed. Sjogren Two Plane Roll Straighteners do their duty each day, every day in the year.

LEFT HAND
For Wire Diameter
3/16-3/8"



Sjogren TOOL & MACHINE CO., INC.
SINCE S&S 1887

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • CAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

Used by Wire Men Who Want the Best!

14 SWORD ST. • AUBURN, MASS.

No. 2,997,519, MULTICOAXIAL LINE CABLES, patented August 22, 1961, by Marion E. Hines, Summit, and Gordon Raisbeck, Bernards Township, Somerset County, N. J., assignors to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

Each of the coaxial outer wire conductors has a number of electrically conductive strips each bent successively to form a number of open, longitudinal, parallel, half-hexagonal channels, alternate ones of the channels being open on one side of the strip and intervening ones of the channels being open on the opposite side of the strip, with means positioning the strips in juxtaposition thereby to form a closely-packed honeycomb bundle of the outer conductors, each of the outer conductors being hexagonal in cross section, and means positioning each of the inner conductors in a respective one of the outer conductors.

* * *

No. 2,998,032, WIRE SINUATOR, patented August 29, 1961 by Stephen A. Platt, 1100 Fulton St., Grand Haven, Mich.

Movable dies pins are provided about which the wire is alternately wrapped while others of the pins are in inoperative positions, and cinching heads are urged against the wire wrapped around each of the pins while the other of the pins is in an inoperative position.

* * *

No. 2,998,242, STRESS EQUALIZED COIL SPRING, patented August 29, 1961 by John G. Schwarzbeck, 2610 Illinois Ave., South Gate, Calif., and Henry O. Fuchs, 2323 Pinecrest Drive, Altadena, Calif.

The turns of the spring have oval cross-sections in axial radial planes and characterized in that the section curvature presented inwardly toward the coil axis has the outline shape of half an ellipse bisected by the ellipse minor axis and the major axis of which extends normal to the coil axis, the section curvature presented outwardly away from the coil axis having the outline shape of a half circle the diametrically opposite sides of which extend tangent to the opposite sides of the half elliptical section curvature.

* * *

No. 2,998,472, INSULATED ELECTRICAL CONDUCTOR AND METHOD OF MANUFACTURE, patented August 29, 1961 by Lewis A. Bondon, 90 Yantacaw Brook Road, Upper Montclair, N. J.

Surrounding the central wire conductor are a number of deformed hollow non-conducting tubes of resilient material, all enclosed by a hollow cylindrical jacket. The non-conductive tubes are in contact one with two next adjacent tubes and in contact with the wire conductor and the size of the non-conductive tubes being, when in undeformed condition, the size which would place each of the tubes in contact with at least three other of the tubes while they are in undeformed condition.

No. 2,998,633, WIRE CUTTING, STRIPPING AND TERMINAL ATTACHING MACHINE, patented September 5, 1961 by Karl H. Andren, West Allis, Wis., assignor to Artos Engineering Company, Milwaukee, Wis., a corporation of Wisconsin.

After the wires are severed and one of their ends stripped of insulation, the stripped ends are guided and inserted into a socket, the insertion being limited by a stop when the wire ends are properly inserted.

* * *

No. 2,998,694, CABLE TWISTING SYSTEM, patented September 5, 1961 by Otto Haugwitz, La Celle Saint Cloud, France, assignor to Societe Anonyme Geoffroy-Delore, Paris, France, a French company.

There are 12 claims in this patent in which the cable wires are twisted progressively and in an order of twisting.

* * *

No. 2,998,903, GARMENT DRYING HANGER, patented September 5, 1961 by Gloria H. Day, 336 W. Magnolia Ave., Auburn, Ala.

The hanger is constructed substantially wholly of wire, but in detachable sections, and includes several curved sections, one below another.

* * *

No. 3,000,405, APPARATUS FOR STRIPPING INSULATION FROM WIRE, patented September 19, 1961 by Carmen L. Basile, Pankracy Terry, Ralph R. Tullgren, and Robert R. Kaufmann, all of Chicago, Ill., assignors to Taylor Spring and Manufacturing Company, Chicago, Ill., a corporation of Illinois.

Rotatable strippers engage the insulation and are advanced as they rotate as well as inwardly radially of the insulation.

* * *

No. 3,000,406, CABLE TRANSPOSING MECHANISM, patented September 19, 1961 by Clifford S. West, Adams, Mass., assignor to General Electric Company, a corporation of New York.

A strand pusher is included, for laterally

COPPER - Consumption of refined copper in the United States, May-June 1961, in short tons

	Wire mills 1/	Brass mills 2/	Chemical plants	Secondary copper smelters	Foundries and miscellaneous	Total
May:						
Cathodes	------	13,113	(3)	136	(3)	13,249
Wire bars	68,831	3,301	(3)	---	(3)	72,132
Ingots and ingot bars	969	11,802	(3)	200	(3)	12,971
Cakes and slabs	------	15,328	(3)	2	(3)	15,330
Billets	------	18,880	(3)	---	(3)	18,880
Other	78	------	(3)	1	(3)	79
Total	69,878	62,424	(4)	339	(4)	4/134,641
June:						
Cathodes	------	12,996	(3)	73	(3)	13,069
Wire bars	79,496	2,822	(3)	---	(3)	82,318
Ingots and ingot bars	892	8,591	(3)	160	(3)	9,643
Cakes and slabs	------	14,032	(3)	2	(3)	14,034
Billets	------	20,712	(3)	---	(3)	20,712
Other	62	------	(3)	---	(3)	62
Total	80,450	59,153	(4)	235	(4)	4/141,838

1/ Includes all wire mills with rod-rolling facilities. 2/ Includes all brass mills using copper in refinery shapes; some have rod-rolling facilities. 3/ Not available. 4/ Consumption by chemical plants, foundries, and miscellaneous plants not included. Estimate of 2,000 tons included in total.

transposing a strand of a lengthwise moving stranded cable. The pusher has two simultaneous components of movement during its strand transposing operation, one of which being in a direction which is parallel to the length of the cable and the other being in a direction which is perpendicular to the length of the cable, and the speed of the one component being equal to the speed of lengthwise movement of the cable.

* * *

No. 3,000,407, ELECTRIC LAMP MOUNT MAKING METHOD AND APPARATUS, patented September 19, 1961 by John W. Anthony and Norman W. Lewis, Cleveland, Ohio, assignors to General Electric Company, a corporation of New York.

More specifically this patent relates to a holder for supporting and carrying the mount to a number of stations. There are 5 claims.

* * *

No. 3,000,580, COIL WINDER, patented September 19, 1961 by Mitchel J. Matovich, Jr., 196 Lyndhurst, San Carlos, Calif.

This winder is of the type wherein a closed loop of wire is rotated by means of a pair of rotatably mounted spaced pulleys around the portion of a workpiece around which it is desired to wind wire turns to pull a length of wire attached to the closed loop on the pulleys to form an adjacent loop.

* * *

No. 3,000,589, WIRE COIL CARRIER, patented September 19, 1961 by Walter G. Patterson, Atlanta, Ga., assignor to Atlantic Steel Company, Atlanta, Ga., a corporation of Delaware.

A central core or post is provided for this collapsible carrier which core is adapted for vertically engaging a keeper shaft of a wire mill block, as well as revolving arms which are sometimes used in the pay-off of wire from a coil.

* * *

No. 3,001,555, AUTOMATIC GRID MAKING MACHINE, patented September 26, 1961 by Junius B. Neale, Owensboro, Ky., assignor to General Electric Company, a corporation of New York.

Cam-controlled actuation is provided for stop-swaging dies for the support rods or wires which are rotatable with a grid electrode-forming mandrel and a mandrel-receiving arbor of a grid-making machine.

* * *

No. 3,001,556, AUTOMATIC GRID MAKING MACHINE, patented September 26, 1961, by Marvin C. Eans, Jr., and Junius B. Neale, Owensboro, Ky., assignors to General Electric Company, a corporation of New York.

Combined continuous grid electrode-feeding device is provided with rod or wire severing claims.

* * *

No. 3,002,047, COAXIAL CABLE, patented September 26, 1961 by Orlando A. Mannella, Forest Park, Ill., assignor to Amphenol-Borg Electronics Corporation, Broadview, Ill., a corporation of Delaware.

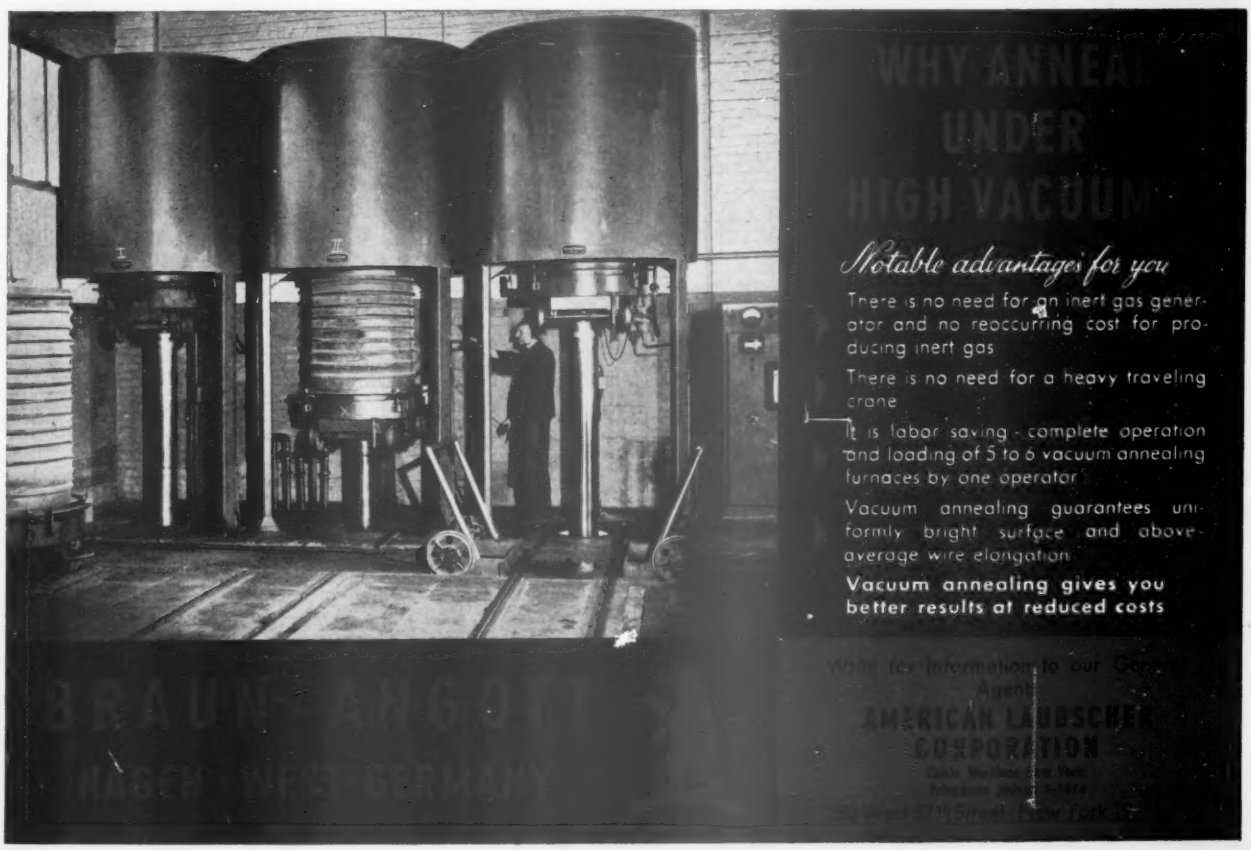
About the wire conductor are layers of 75% staple fiberglass interwoven with 25% continuous filament fiberglass, then continuous filament fiberglass layer metallic braid, and an outer stainless steel hose. The cable is, of course, for radio frequency transmission.

Measures and Controls Temperature

Continuous temperature measurement and temperature control of inaccessible, fragile or rapidly moving objects, at temperatures as low as 300°F., is now possible at reasonable price with the new Pyrotel Model PY45. The instrument is one of the many models of non-contacting, infrared radiation pyrometer-controllers manufactured by **Mason Instrument Co., Inc.**

* * *

The incorporation of a synchronous chopper assures stability, sensitivity and rapid response times of 20 milliseconds, enabling accurate, repeatable temperature readings on targets such as wire travelling at 5000 feet per minute. The precision built detector head permits temperature reading of targets as small as .0003" wire or as large as "the side of a barn." Extensively used with induction and resistance heaters, the PY45


Notable advantages for you
There is no need for an inert gas generator and no reoccurring cost for producing inert gas
There is no need for a heavy traveling crane
It is labor saving - complete operation and loading of 5 to 6 vacuum annealing furnaces by one operator
Vacuum annealing guarantees uniformly bright surface and above-average wire elongation
Vacuum annealing gives you better results at reduced costs

features built-in relay to provide warning signals for manual adjustment, or for efficient, automatic, step control of heaters. Where stepless or proportional control is desired, the instrument furnishes power outputs for driving a reversible motor to achieve this type of control.

* * *

For further information, write **Mason Instrument Co., Inc.,** Dept. 45, 222 Valley Place, Mamaroneck, N.Y.

To Make Color Concentrates for Vinyls

Apex Tire & Rubber Co. of Pawtucket, R. I., has established a Color Division for the manufacture and marketing of a diverse line of color concentrates for vinyl processers. The new division will complement the company's present activity as a major producer of vinyl compounds for extrusion and molding.

* * *

Products of the Color Division include concentrates in pellet, paste, and powder form. Color concentrates are available for the wire and cable industry which meet NEMA standards. Standard color concentrates based upon commonly used pigments have been established for the calendering and coating industries. The company's laboratory facilities and personnel staff have been expanded to provide a broad base of experience for custom matching and color development services to supplement these standard lines.

* * *

Products of the Color Division of the Apex Tire & Rubber Co. will be merchandised through the existing Plastics Division Sales organization operating in the United States and abroad.

New Wire Cutter for Removing Wire from Reels

R. S. Watkins & Sons, Inc., Glen Road, Sandy Hook, Conn., builders of wire drawing and other wire processing equipment, has developed a novel Oscillating Wire Cutter for the removal of wire from full or partially filled spools or reels.

* * *

Model A, the standard machine, has a wire diameter range of from .0004" to .018", depending on the alloy wire on a spool. It operates quickly, cleanly and efficiently, without damaging or marking the spool drum.

* * *

The standard model handles spools from the smallest to 8" in diameter. The Heavy Duty Model will take spools up to 16" flange diameter and wire of up to .050 inches.

* * *

Many of the country's largest wire companies now are using these unique wire cutters for salvaging both wire and spools. Cutter blades are readily removed for replacement or servicing.

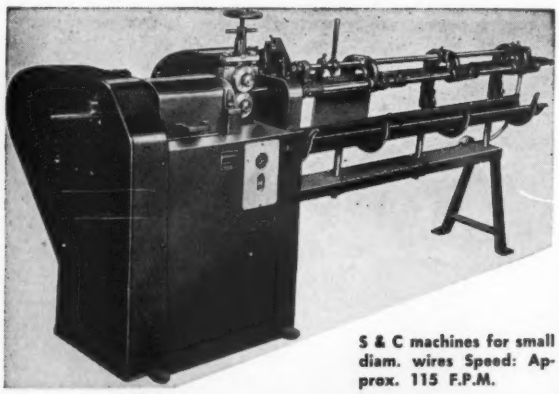
* * *

A brochure illustrating and describing the cutters will be sent upon request to the company.

FAST! ACCURATE! RELIABLE!

CHARACTERISTICS OF THE

WELLS STRAIGHTENER & CUTTER



S & C machines for small diam. wires Speed: Approx. 115 F.P.M.

The time-proven WELLS line combines maximum efficiency with that rugged dependability, for which WELLS S&C machines have become justly famous.

Built in several sizes to handle 2 to 18 ga. basic and high carbon wire.

FEATURES

The guide bar of these fine machines can be supplied for any cut lengths • The rotary flier runs on ball bearings for smoothness and long life • Cut-off is actuated by a solenoid for extreme accuracy of cut lengths • A two point cam construction provides a quick and positive return of the cut-off knife, eliminating the need for a clutch and dog • A counter is standard equipment.

A COMPLETE RANGE OF S & C MACHINES IS MADE BY WELLS FOR ALL SIZES OF WIRE. SEND FOR CATALOG ON THE COMPLETE LINE.

Frank L. Wells Company

Builders of Fine Wire Working Machinery

5821 FIFTH AVENUE • KENOSHA, WISCONSIN

Bulletin on Wire Temperature Measurement

Mason Instruments, Inc., 222 Valley Pl., Mamaroneck, N. Y., has issued literature describing the new Infrared Radiation Pyrometer by which the temperature of wire can be measured at speeds of up to 5000 feet per minute.

* * *

In the manufacture of insulated wire, for example, scrap and rejections can be reduced sharply with the use of this device in the production line. Or it can be used for monitoring temperatures of rod and wire in patenting, annealing, stress relieving or tempering. In hot dip coating operations, temperatures can be read and controlled.

* * *

The bulletin and a questionnaire will bring readers full information on specific wire applications. Write the company at the address above.

New Miniature Parts Header

REM Sales Inc. has announced the availability of an improved Model "00" Solid Die Double Stroke Cold Header for miniature parts. The major design change consists of a variable Speed Drive arrangement allowing instantaneous speed adjustment while the machine is in operation. By turning a hand dial, fly wheel speed can be adjusted between 150 & 300 RPM, thus permitting the operator gradually to "tune in" to the desired operating speed after a job is set up.

* * *

This Cold Header is built into a desk-type cabinet base having tool storage drawers and work-receiving pans. The motor drive is housed in the cabinet, supported by a metal framework. The machine is provided with a one-shot lubricating system.

* * *

Having wire diameter capacity from .012" to .070", this Cold Header was developed particularly for the manufacture of tiny components such as electrical contacts, optical screw blanks, and other miniature rivet forms. A special Die Block and mechanism included with the standard equipment allows deep hollowing of rivet shanks in soft materials such as aluminum and fine silver, although the machine is not claimed to be a tubular rivet header. A Single Stroke model for heading balls up to .0625" finished size also is available.

* * *

Additional information is available by writing: REM Sales, Inc. P.O. Box 41, West Hartford 7, Conn.

* * *

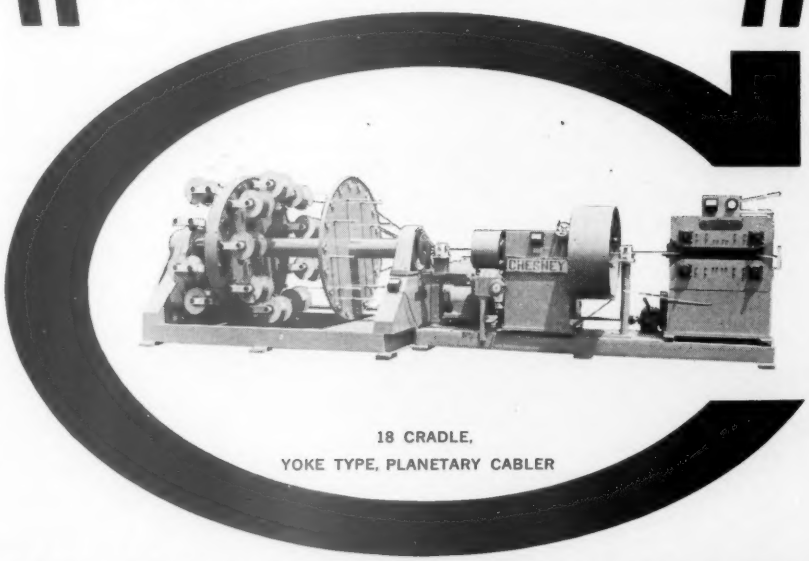
Phosphating News

Many large industries now use phosphate coatings to provide a base for the paint subsequently applied to motor cars, domestic appliances and metal goods of all kinds, for lubrication during the cold forming of metals and for electrical insulating purposes, particularly with sheet steel. Hitherto there has been no periodical to cover the trade news, literature and patents appearing about this field.

* * *

"Phosphating News" is an at-

A Chesney Quotation or Proposal Tells The Difference



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YOKE TYPE, PLANETARY CABLER

EASY, SIMPLE ONE-MAN-HOUR INSTALLATION
PLUS SPACE SAVING STREAMLINED DESIGN

The years-ahead Chesney Cabler speeds production with simplicity-by-design to prevent down time, minimize maintenance. **Features include:**

CAPACITY: 18 yoke type cradles, 12" dia. x 10" wide reel capacity.

SPEEDS: Max. rotor speed 60 RPM, infinitely variable.

PLANETARY: Chain generated action.

TAPING HEAD: Tape tension constant thruout run. Two pad eccentric, capacity 12" dia. x 2" width. Speed infinitely variable to 900 RPM. Pad binder head for nylon or cotton serving bundles.

CAT-TRACK CAPSTAN: Lay range infinitely variable from 1½" to 18".

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tempt to fill this gap with a small monthly review of phosphating information collected from all over the world and is directed at both the user of phosphating processes and the suppliers of methods, chemicals and equipment. It will be issued in duplicated form, like our other periodicals, during the second week of every month and is supplied on subscription at a cost of £2 a year or £2.15.0 airmail (U. S. A. and Canada $6 a year or $9 airmail).

Torrington Co. Building Two New Plants

Torrington Co., Torrington, Conn., has launched a $6 million expansion program to provide a wire mill adjacent to its Broad Street plant in Torrington and a bearing manufacturing plant near Clinton, S. C.

* * *

The company plans to draw its own wire from rods in a new 43,000 sq ft wire mill in Torrington. The wire will be used in the manufacture of needle rollers and needle bearings. The buliding will be completed by September and equipment installed during October and November.

* * *

The Clinton bearing plant will contain 140,000 sq ft of manufacturing and office space. Initial production will include needle bearings and needle rollers.

Upset Tester For Cold Heading Steel

The Manco Mfg. Co. has announced two companion units of hydraulic equipment for use in testing mild steel for cold heading. One of the units is a shear for cutting slugs of the metal to the required length and the other does the actual upset testing.

* * *

The small shear cuts the metal into slugs of proper length in proportion to its diameter. Cutting time is 1½ seconds. Diameters from 3/16″ to 3/4″ can be accommodated in the 3 place die and blade. Die and blade sets can be provided for any desired diameter or combination of diameters within the 3/16″ to 3/4″ range. A die and blade change in the shear can be made in about 3 minutes.

* * *

Slugs cut by the shear are placed in the upset tester. An hydraulically operated ram performs the upset test in an enclosed chamber in the upper body of the tester. A complete test cycle takes about 2½ seconds. Any percentage of upset desired may be obtained through an adjusting wheel, and there is a scale indicator graduated in 32nds.

* * *

Both units are powered by a single electric motor driven pump delivering 3 g.p.m. and providing 35 tons thrust. Weight of the shear is 70 lbs. and weight of the upset tester is 90 lbs. They are designed for bench mounting. Complete information may be obtained by writing to the Manco Mfg. Co., Bradley, Illinois.

ALUMINUM INGOT AND MILL PRODUCTS: DECEMBER 1960

(Shipments and receipts are in thousands of pounds)

Item	Number of companies reporting shipments	December 1960			November 1960* net shipments	December 1959* net shipments
		Gross[1] shipments	Receipts[2]	Net[3] shipments		
ALUMINUM PIG AND INGOT, TOTAL	82	242,717	90,595	152,122	132,889	212,203
ALUMINUM MILL PRODUCTS, TOTAL	162	237,184	11,872	225,312	236,843	268,037
Sheet and plate, non-heat-treatable	30	89,452	7,933	81,519	92,481	107,977
Sheet and plate, heat-treatable	5	(D)	(D)	18,827	13,825	15,859
Foil, including foil in lamination	15	(D)	(D)	20,230	21,450	19,361
Rolled, and continous cast rod and bar	7	11,240	2,439	8,801	6,687	8,248
Wire, bare, conductor and nonconductor	15	3,660	109	3,551	3,822	5,347
ACSR and aluminum cable, bare	10	14,101	146	13,955	12,138	13,816
Wire and cable, insulated or covered	15	5,179	...	5,179	5,244	4,947
Extruded shapes, alloys other than 2000 and 7000 series	104	58,103	879	57,224	66,249	72,793
Extruded shapes, alloys in 2000 and 7000 series	7	(D)	(D)	4,108	3,529	4,113
Drawn tube, alloys other than 2000 and 7000 series	11	4,100	17	4,083	3,953	5,621
Drawn tube, alloys in 2000 and 7000 series						
Welded tube, non-heat-treatable	5	1,606	...	1,606	955	2,421

*Revised.

D Withheld to avoid disclosing figures of individual companies. These figures are included, however, in the appropriate total.

[1]Gross shipments of mill products represent total shipments by producers to customers, including other producers, and shipments by producers to their own fabricating departments which manufacture products beyond the level of mill shapes. Ingot gross shipments include shipments by importers.

[2]For mill products, represents receipts from domestic producers only. In addition to receipts from domestic producers, 396,000 pounds of mill shapes were received through imports. For ingot, receipts from imports are included.

[3]For mill products, derived by subtracting the sum of producer's domestic receipts of each mill shape from the industry's gross shipments of that shape. Ingot data derived by subtracting all receipts from shipments reported.

Low Viscosity Epoxy Resins For Filament Winding

Two new epoxy resins are now available for filament winding systems requiring high tensile elongation and good handling characteristics. Developed by **Union Carbide Plastics,** they are designated Bakelite ERL-2256 and Bakelite ERL-2258. They join the recently announced Bakelite epoxy ERL-0500 to make a total of three epoxy resins specially developed to help meet exacting requirements encountered in the filament winding process, especially for missile applications.

* * *

Both ERL-2256 and ERL-2258 have excellent physical properties and handling characteristics that make them ideal not only for the filament winding technique but also for laminating applications. ERL-2256 is especially recommended for both wet layup and bag molding.

The new resins cure well with anhydrides and aromatic amines at room temperature but are not recommended for use with Methyl Nadic Anhydride.

New Bonding Agent for Vinyls

A new versatile, clear adhesive for bonding vinyl to vinyl or vinyl to metal has been announced by **United States Rubber Co.** The formulation, a synthetic resin-based adhesive, prevents solvent reaction by plasticizer migration and is non-staining on even the lightest colored vinyls.

* * *

On a two surface coat application, the drying time before bonding can vary from a few minutes to 30 minutes. In some instances, a one surface coat of the material will produce a strong bond. In such cases the M-6105, as the new adhesive has been designated, should be applied liberally to the metal and the vinyl should be laminated within one minute. The adhesive can be applied by brush, spray or roller.

* * *

The new formula was developed in the laboratories of U. S. Rubber's Mishawaka, Ind., plant.

Beryllium Copper for Undersea Cables

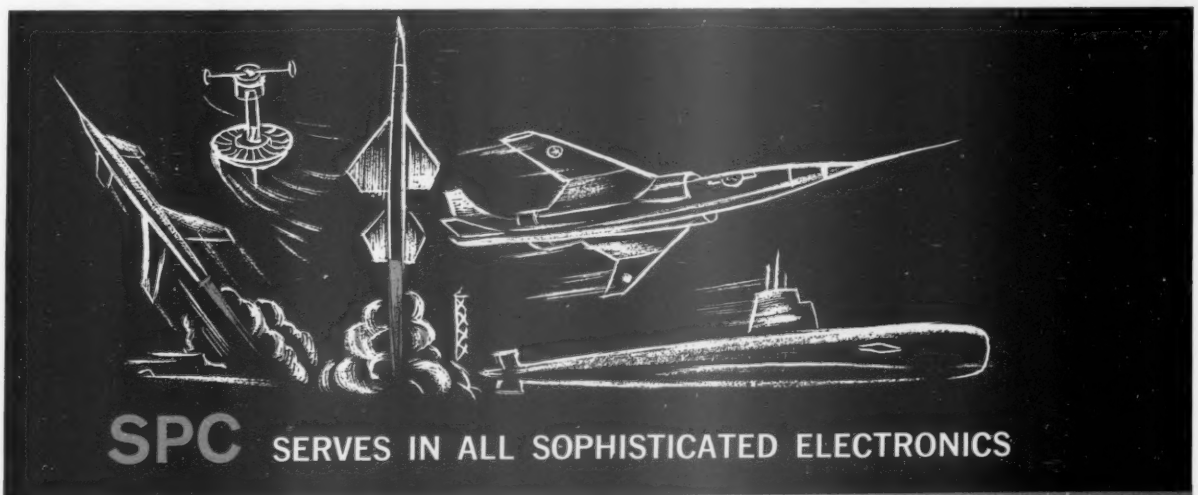
Beryllium Corporation, Reading, Pa. has received an order from **Western Electric Company** for American Telephone & Telegraph Co. installation amounting to $1,000,000.

* * *

The beryllium copper alloy is to be used for copper casings and couplings for an undersea cable to connect the U. S. and Jamaica in 1962 and the U. S. and Great Britain in 1963.

* * *

The alloy, 16C, to be used has unusual strength, hardness and resistance to corrosion and pressure.



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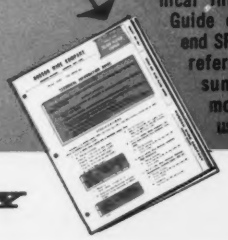

HUDSON WIRE COMPANY

OSSINING DIVISION, OSSINING, NEW YORK / TELEPHONE: WILSON 1-8500

Test Report: Man-Made Diamonds for Diamond Die Finishing

(*Continued from page* 1559)

dies using Grade 1, U.S. Bureau of Standards Powder of an 0-2 micron particle size. Experiment 2 consisted of 28 sets of dies using Grade 3 or 1-5 micron particle size. Experiment 3 consisted of 8 sets of dies using Grade 15 or 8-22 micron particle size and the dies started at .0104" to .0123".

* * *

In the first experiment the starting sizes of the dies ranged from .0013" to .00135". These tests indicated a superiority for natural diamond in these small die sizes. The stock removal was 5.58 for natural to 2.90 for Man-Made, or a superiority of 93% for natural.

* * *

The first part of the second experiment involved 12 sets of dies starting at .0044". Here the Man-Made showed a marked superiority by removing .00525" to .003" for natural, or a superiority of 226%. In the second part of this experiment the natural removed 48.30 to 46.60 for Man-Made, a 4% edge for the natural. It should be noted that this second part of the test was conducted on the smaller die sizes.

* * *

In experiment 3 there were 8 sets of dies at .010" to .0125". In this experiment the G.E. Man-Made had a definite superiority over natural. The total stock removal for Man-Made was .0085" compared to .0072" for natural — a 40% superiority for Man-Made.

* * *

The results of these field tests compare closely to the results obtained in laboratory tests conducted at Elgin and indicate broad guides to applicatfon of these two diamond types for finishing diamond dies. They can be summarized as follows:

1. **In the smaller die sizes (up to .0045) using fine powder (0-2 micron) the natural powder has shown superiority.**
2. **In the larger die sizes (.0045 and larger), and using Grade 3 and coarser material, the Man-Made material has shown a marked superiority.**

* * *

Testing, of course, continues. Evaluation of new data will continue in order to study the possibility of even further product improvement or broadening the application range.

Buhova Trade Letter

The Bureau Voor Handelsinlichtingen, Oudebrugsteeg 16, Amsterdam - C, Holland, has issued its annual Buhova Trade Letter, in which are listed those firms in the Netherlands interested in export or import trade relations with firms abroad.

* * *

A copy of the letter will be sent by the Bureau upon request to interested parties.

WANTED:

Used 4-Slide Wire Forming Machines, Headers and Pin Pointing Machines. Ready to buy. Will pay spot cash.

Send all information, conditions and where machines can be inspected to:

NATIONAL CHAIN COMPANY

387 Charles Street

Providence 4, Rhode Island

Rolling Flat Wire in High-Speed Multi-Stand Mills

(*Continued from page* 1531)

The actual tolerances that can be obtained on any given production run depend a great deal on the amounts of time and scrap material that can practically be consumed in setting up the mill. In preparing for a very long run, for example, the relative cost of additional time and scrap in an unusually precise mill set up is small. Much of the machine time since installation, for example, has been devoted to producing .016x.320-in. copper tape for further fabrication in the manufacture of telephone cable. Although the tolerance of ±.003 in. on width is quite liberal, a specified maximum variation of ±.0005 in. on thickness has been continuously maintained.

* * *

While it is certainly desirable to run any particular wire size at the highest possible linear speed, operating speed affects surface condition and therefore must be selected on the basis of quality requirements. If the wire is run at too high a speed, there may not be sufficient cooling by the water-soluble lubricant and the copper surface may become discolored. Although ASTM standards are quite liberal on surface oxidation, company standards require that the copper surface be completely clear by visual inspection.

* * *

In Figure 1, the wire reel at right is mounted on the arbor of a winder in which a traversing mechanism develops a reciprocating motion to distribute the wire evenly over the reel width. The take-up mechanism is initially set by the operator and adjusted during the run, if necessary, so as to match properly the operating speed of the mill and width of the reel.

Set-Up Sequence and Operation

The step-by-step sequence of operations in setting up the high-speed flat wire mills is:

1. **Put supply reel in back stand.**
2. **Pound flat section on end of wire.**
3. **Set each flattening roll in the mill stands to the desired thickness.**
4. **Feed end of wire into first mill stand.**
5. **String wire through second mill stand, finshing stand, thickness gage, width gage and through guides and hook it into the hole on the drum of the winding reel.**
6. **Set width and thickness gages in meters at proper nominal values.**
7. **Adjust rheostat on supply reel motor ("drag reel" in Figure 2), controlling the tension between the supply reel and first mill stand.**
8. **Turn all rheostats down as far as possible so that the wire is jogging through each stand at the same low speed (about 10 ft. per minute).**
9. **Adjust first edging stand by measuring width produced in jogging run with micrometer.**
10. **Adjust second edging stand.**
11. **Bring mill up to a speed of about 100 ft. per minute.**
12. **Adjust rheostats down the line from first mill stand to tension on winding reel.**
13. **Adjust reciprocating motion on winding reel.**
14. **Stop machine and remove set-up scrap and rehook wire end in winding reel.**
15. **Bring machine up to operating speed.**

IMPORTED STAINLESS STEEL WIRES . . .
COPPER COATED COLD HEADING WIRE
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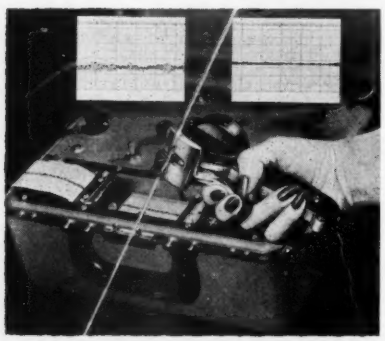
The operator continuously checks the spooling on the winding reel, width and thickness gages, and rheostats during the run and makes any necessary adjustments, unless fully automatic control is provided.

Tension Recorder Shows Tension Changes of Moving Wires, Cables and Tape

A new Electronic Tension Recorder to record tensions at full speed and its changes during all preparatory operations of wires, cables, tapes and yarns, as well as cordage, has been added to Tensitron's line of Tension Meters.

* * *

Different tension controls, coil designs, guides, traverse action, RPM, and other engineering factors influence tension, as does the wire when it builds up on a spool or package, or is pulled off. Sudden tension changes are resolved such as when thin resistance wires are wound around square cards for potentiometers, or when winding flat grids for radio tubes.



The records (in the upper part of the illustration) show tension of the same material coming from a pirn as compared to delivery from a spool. With identical settings, the record at the right shows a lower, more uniform tension, while the left one has greater variations, thus subjecting the sensitive wire to damage.

* * *

For detailed information, write **Tensitron Inc.**, Harvard, Mass.

Wire Kinks

(*Continued from page* 1571)

angles are used for intermediate drafts, the ripper should have a 22° to 24° angle.

* * *

6. Low carbon wire can take heavy drafts and 20° on the ripper and 16° on the intermediate dies is good practice. Medium carbon wire should have about the same angles for low. High carbon seldom is drafted over 30% on each pass and angles generally are 16° on the ripper, 14° on the intermediate and 12° on the finishing die. When high carbon or spring or rope wires are drawn with 20% to 25% reductions, a 12° angle generally is used.

* * *

7. The answer may be "yes", but it is not always so. The angle must be large enough to allow plenty of lubricant to get into the die, but if too large it may not enter the die properly. The amount of lime, borax or other carrier on the rod is more important than the die angle in enabling the wire to pick up the lubricant well.

* * *

8. A lime and soap mixture makes for smoother wire drawing. Mixing lime with a lubricant can be overdone. Mixing ideas and practices differ and some experimentation can show what is best for your machines, dies and speeds.

* * *

9. Even though your dies remain cool, the wire becomes hot and water cooling will not affect lubricity.

* * *

10. Waste wrapped around the wire can serve to remove slivers from the wire that otherwise might get into a die and cause scratching. Also, if a soft grease is used as a lubricant, it will remove any excess from the wire.

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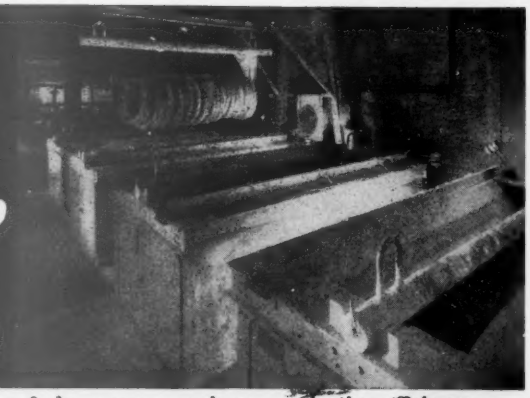

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FREE TECHNICAL SERVICE Trained Ludlow technicians will give you an on-the-job analysis of your spiralwrapping problems on coils, rods, strips, hose, etc.

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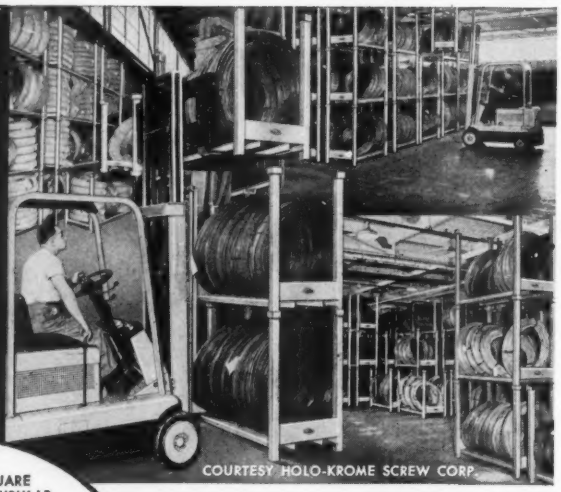
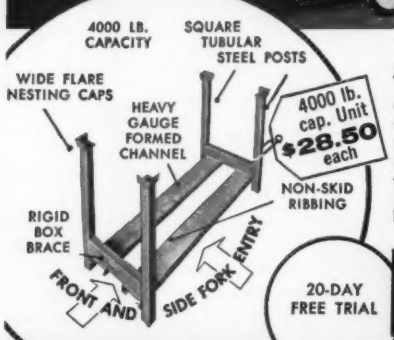


COURTESY HOLO-KROME SCREW CORP.



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Introduction to Inventory Management for the Distributor

(*Continued from page* 1567)

stock and we ran it again and here's what we got. The average inventory level went up almost a 100 units. The purchase costs were the same. The shortage picture was much better — we were short only 1% of the time — we were able to fill 99% of the orders we received. Management can ask themselves this question. Is it worth a 100 units of stock on hand to decrease our shorts from 4% of the time to 1% of the time? This worked so well we added another 50 units to the safety stock and ran it again. Look what happened. The average inventory level went up just about 30 units. The purchase costs were still $100. The shortage picture was absolutely the same. No improvement whatsoever. Did we gain anything by adding these 50 units to safety stock? The simulator indicates not. We tried another approach, we reduced the purchase quantity from 300 units to 200 units. We still left this 100 unit safety stock, and we ran it again and here's what happened. The inventory level dropped over a 100 units. Purchasing costs went up $50. This is understandable. We weren't purchasing quite as much as we were before so we had to place purchase orders more frequently. How about service? It was off one tenth of 1%.

* * *

Management can now ask themselves this question. Is it worth a 100 unit reduction in inventory if we miss one tenth of 1% of the orders we receive and have to spend $50 every two years in purchase costs? Gentlemen, with the inventory management simulator and the application of these scientific management techniques, the customer can try his various possible inventory systems and get the information that he needs to intellgently select the proper one to meet his needs. This means, to repeat, that the customer by using the inventory management simulator is provided with pretested inventory policy and a pretested plan

of action. This leads to double profit. Not only does he realize the benefits of an intelligently established inventory plan, but he can automate the entire thing.

* * *

Gentlemen, with the use of this tool we have successfully blasted Stage 3 of our rocket and we've now got our rocket in its profit orbit. The customer is in a position to maximize his profits through effective inventory management.

"Alathon" for Wire & Cable

Availability of a semi-conducting polyethylene resin for replacement of fabric shielding on high voltage cabling has been announced by **Dr. Michael A. Kubico,** wire and cable industry manager for du Pont's Polychemicals Department. The resin may be applied as an extruded layer or as wrapped tape.

* * *

Developed to meet rigid requirements of the Minuteman missile, "Alathon" 2900 BK 50 high density polyethylene resin is used primarily as an electrostatic shield on insulated wire and cables for control and communications. It is under evaluation for additional commercial and military uses.

* * *

The resin's semi-conducting nature spreads an electrical charge — from lightning, for example — over a large cable area. This distribution greatly reduces the chance of a hole being blown in the cable jacket.

* * *

The copolymer resists cracking when bent, despite high carbon content. It has passed environmental stress crack standards set by ASTM. In addition, its excellent combination of properties includes toughness, flexibility at low temperatures, moisture, corrosion, and chemical resistance.

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C CURING
D DRYING
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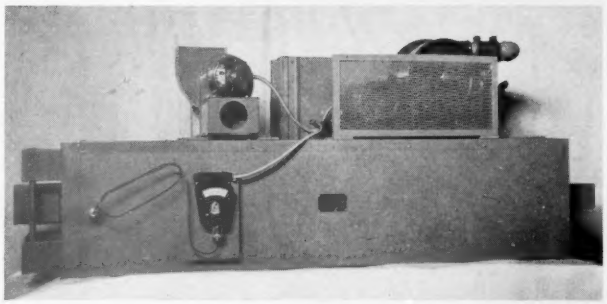

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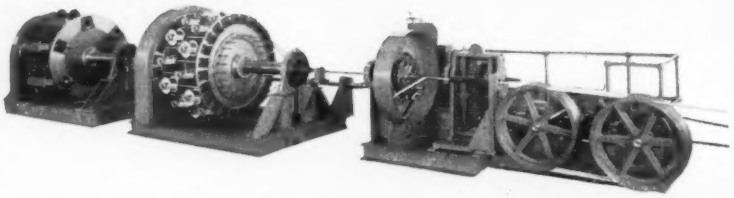

A very efficient machine built for producing cables where a small number of large conductors and a larger number of smaller conductors and fillers are used in the construction.

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Capstans are dual 4 groove 30 inches diameter and are driven through a variable speed device.

This Planetary Cabling Machine is one of a number which we have built handling reels 8, 10, 12, 16, 19, 24, or 30 inches in diameter. We can supply Standard Units to meet practically all requirements.

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GUEST KEEN and NETTLEFOLDS ORGANIZE AMERICAN SUBSIDIARY

Two recent visitors from England were Mr. N. R. R. Brooke and Mr. Claude Parson of Guest, Keen & Nettlefolds Limited.

Mr. Brooke is a Director of the parent company and Managing Director of Guest, Keen & Nettlefolds (South Wales) Ltd., and Mr. Parson is a senior Executive of the group.

On their visit to the U.S.A. they have finalized arrangements for the formation of an American Company, Guest Keen & Nettlefolds (South Wales) Inc. and the opening of their own office in New York on November 1, 1961, to handle their substantial business in Wire Rods, Wire, Strip, Nails, etc.

This office will be under the direction of Mr. W. G. Stone, late of Ferric Industries, Inc. Mr. Brooke has been appointed President and Mr. Stone, Vice President.

The new office is located at 122 East 42nd Street, New York 17, N. Y.

Unusual Photocell Loop Control System for Wire Rod Mill

(*Continued from page* 1542)

rod mill, and three motors in the looping mill, are equipped for loop-regulation. The speed of the fourth stand in the looping mill is constant and regulation is "forward" in the continuous rod mill and "backward" in the looping mill. This means that the loop regulator in the continuous mill controls the speed of the following stand, and, in the looping mill, the speed of the preceding stand.

* * *

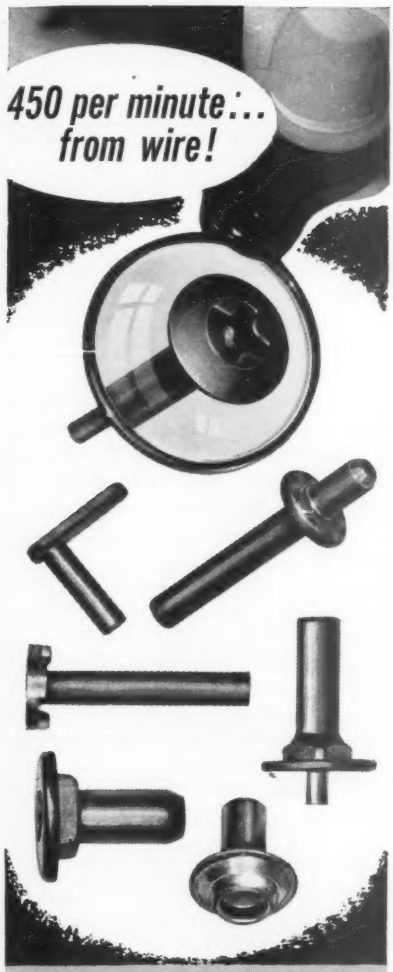
In the rod mill, greater demands are made on regulation than in the looping mill. For this reason, in the former, the loop-regulation equipment is supplemented by a device which automatically corrects the loop position with reference to temperature variations, roll wear, etc. (refer to Fig. 5). The criterion for the most suitable loop position is that the voltage from the loop regulator should be zero. While this voltage directly regulates the motor speed extremely rapidly, it also, via a transducer amplifier and a slow-running motor operating device, resets the reference voltage for the basic speed as soon as the voltage from the loop indicator begins to deviate from zero.

* * *

This additional regulation means that the rolling mill automatically sets itself at the correct motor speed even though, when going over to a new rolling program, or after changing rolls, it should happen that the speed has been incorrectly set. After changing a rolling program at the Aosta Works, the speed is set so that the rod is stretched between the stands. The loop regulation intervenes and then adjusts the motor speed so that, a moment later, all the loops are at the correct level. By this means, material wastage is avoided.

* * *

The speed of the pinch rolls before the looping mill is so regulated as to follow the speed of the intermediate mill. In the same way, the speed of the pinch rolls before the coilers is regulated so as to follow the speed of the stand



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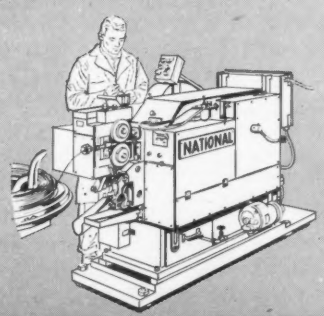

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TIFFIN, OHIO, U.S.A.
HARTFORD DETROIT CHICAGO

actually supplying the rod. The regulation of the pinch rolls is a combination of speed, and current-limit regulation, so arranged that the pinch rolls at no load adjust their speed to that of the roll stands in question, and when under full load work at a constant torque (Fig. 7).

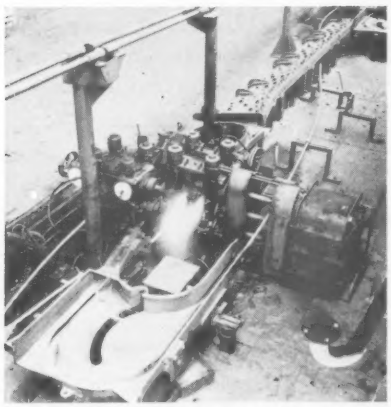

Fig. 7 — Horizontal repeater with built-in potentiometer resistor for loop regulation.

Since the coiler motors have to be able to start and stop individually, each is fed by its own generator. Therefore, complete regulation is brought about by means of varying the generator voltage. During coiling, the speed is regulated in relation to the outgoing speed of the rod and the load then is quite insignificant. During acceleration and retardation, current-limiting regulation intervenes and, in order to reduce the time taken from the above operations, the current limit can very well be set somewhat higher than the rated current of the coiler motor.

* * *

It might be thought that a relatively complicated regulation equipment of this kind would reduce the service reliability of the rolling mill and that it would call for highly qualified service personnel. However, experience gained at Cogne shows that this is not the case. Where possible, ASEA use transductor amplifiers in regulation systems for industrial and power plants. Although in recent years electronic tubes have developed considerably and become more reliable, the risk of disturbances in an electronic-tube system still remains. In systems of this kind, currents considerably lower

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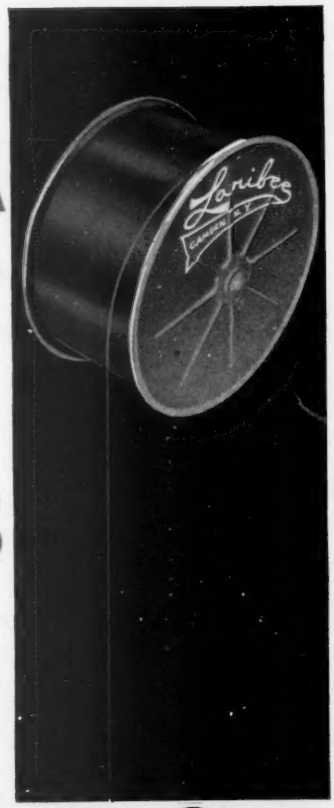

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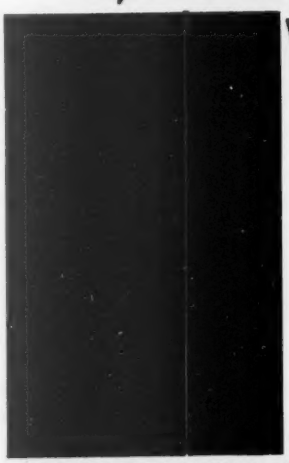

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than those in a transductor system are used and the risk of inductive and capacitive disturbances from adjacent high-current and high-voltage circuits is considerably greater than for the electrically more robust transductor system. Experience has shown that, once a regulating system making use of transductors has been adjusted, no further measures are needed. The transductor characteristics do not change with time, and, practically speaking, only mechanical damage can cause disturbances in a properly designed regulating system of this kind.

* * *

Operational experience has shown that the relative complexity of the loop control equipment in the Aosta rod mills has been very reliable. The use of magnetic amplifiers rather than electronic tube systems may be one reason for the success.

* * *

Acknowledgment is due for data and illustrations to the firms mentioned.

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Surface Defect Detection

(*Continued from Page* 1527)

destructive testing to assure the reliability of the test. Standards of carefully prepared artificial defects may be the solution to this problem. The points of coils must be considerably longer and there seems to be no immediate solution to this minor handicap. The drawing die, the rotating probe, and the take up reel must be in excellent alignment and relatively rigid to reduce the electronic noise level and prevent false indications.

* * *

The various forms of eddy current nondestructive testing have been a significant step toward product perfection. They have helped the steel and wire producer in two ways, one to evaluate his hot mill product and pinpoint some of the hot mill, billet preparation and melting difficulties that create the surface wire defects. More significantly, as eddy current science develops, superior means for isolating steel with surface defects will become available.

The Place of Polyethylene as a Wire and Cable Insulation

(*Continued from Page* 1535)

ufacture of a very reasonably priced cable for approximately 50 kv service. A concentric or braided wire covering over the insulation shielding would also add needed capacity for shorted cable faults.

* * *

Near the year 1948 an inquiry concerning recommended splicing and terminating methods for 15 kv shielded polyethylene cable was sent to several manufacturers. Comments received were: "None at this time". Methods were developed by our group and sent out for comments which were

received and summed up under "None". Approximately a year after field use of these methods, the manufacturers began to have methods of their own which looked very familiar. These methods still look very familiar and since ours were developed without technical assistance and laboratory proof we feel that it is very likely that the present methods of splicing and terminating leave much to be desired. This is further pointed out by recent experiments on polyethylene cable with radio frequency discharges at 20-30 kv, wherein the tests are complicated by termination failures. The terminating methods used are very similar to those used for shielded power cable. The manner of making these terminations should be such that they would **never** fail before the cable insulation. It seems that cable manufacturers, or other specialty companies, have a field here that needs some plowing.

* * *

The glamour fields for cable engineers today are the extra high voltage overhead and underground cables. Some of the electrical manifestations noted will be beneficial to the lower voltage cable development. The use of semiconducting polyethylene as a jacket for EHV overhead cable might have considerable value in protecting the stranding from installation nicks and affording a more corona-free conductor. It is also possible that active research with a broader outlook in the lower voltage field would benefit the glamour group. Polyethylene has more potential for development than any other present insulation.

Silicone Rubber for Aircraft and Missile Wire Insulation

A new, four-page technical bulletin describing the properties and handling characteristics of silicone rubber as they pertain to wire and cable insulation for use in aircraft and missile support equipment is available from the **Silicone Products Department**

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* * *

Designated CDS-158, the bulletin contains comparative data on radiation resistance and dielectric strength of silicone rubber compared to other materials as well as information on such properties as low temperature flexibility, heat resistance, ozone and corona resistance and resistance to weathering and chemical attack.

* * *

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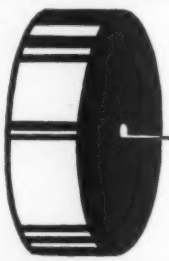

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Harold Warburton Rigby

Mr. Harold Warburton Rigby, Chairman of **John Rigby and Sons Ltd.,** died in Biarritz, France, on September 25th, the day before he was to return home from a holiday in the south of France.

* * *

Mr. Rigby was elected to the Board of Directors in 1926 and had been Chairman for the 12 years prior to his death. He was well-known in the wire industry and had visited the United States

Harold W. Rigby at the time he wound the Association clock in 1958. * * * *

on three occasions to attend conventions of The Wire Association, of which he was a member.

* * *

He called at the headquarters of The Wire Association in 1958 to wind the clock presented on behalf of our British members to the Association in 1948 by **John Rigby,** his brother.

* * *

Mr. Rigby was a member of the Executive Committee of the Institute of Wire Manufacturers and The Patented Steel Wire Association.

Reuben E. Sommer

Reuben E. Sommer, 62, President and General Manager of the **Keystone Steel & Wire Company,** Peoria, Ill., died on October 8 at a hospital in Baden-Baden, Germany, where he had been vacationing since August. Mr. Som-

mer was hospitalized following a brief illness. Cause of death was not attributed.

* * *

Since 1945 Mr. Sommer had served as chief executive officer of the Peoria steel firm, of which his father was a founder in 1889. He joined the company in 1918, and organized the firm's claim department a few years later. He then served as a sales director and later became vice president in charge of sales.

* * *

His election as vice president and general manager of the firm came in 1935, and ten years later, he became president.

* * *

Mr. Sommer was a director of the company and served as Chairman of the Board of **National Lock Co.**, Rockford, Ill., a subsidiary company. He also served as a board member of the **Mid-States Steel & Wire Company**, Crawfordsville, Ind., **Wire Specialties Co.**, Santa Clara, Calif., the Jefferson Trust & Savings Bank, Peoria, and the Toledo, Peoria and Western Railroad. In 1956 he received an Honorary Doctor of Laws Degree from Bradley University, which he attended when the institution was Bradley Academy.

* * *

He married **Martha Bosch**, who survives, in addition to two sons, **Walton B. Sommer**, vice president of Keystone; **Donald A. Sommer**, general sales manager of the firm; a daughter, **Luella Sommer Vermeil** of Peoria; three sisters, **Mrs. W. C. Erkert, Mrs. W. V. McAdoo,** and **Mrs. Emily Dick**, and six grandchildren.

Revised Data on ACSR

New data on conductors, core wires, cable reels, and conductor lengths have been incorporated into a revision of "Aluminum Electrical Conductors, Stranded-Bare," now available from **Rome Cable Division**, Aluminum Company of America.

* * *

The revision includes information on 5005 aluminum alloy conductors, aluminized steel core wire for ACSR, and details on a new size of Expanded ACSR — 2,294 MCM, 2.32-inch diameter.

* * *

The new publication presents, as its principal content, separate characteristics and packaging tables for ACSR and stranded aluminum conductors, and gives conductor cross-section diagrams, and reel and coil data.

* * *

The publication is available through any Alcoa/Rome sales office.

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Some Aspects of the Compatibility of Various Electrical Insulating Materials

(*Continued from page* 1539)

each case as the reference point for measuring deterioration due to the presence of the tubing sample, of the insulation on the magnet wire.

* * *

Our findings are listed in Tables I and II.

* * *

In our next tests, which are presently going on, we will determine the dielectric strength of the insulating tubing before and after the heat aging to learn if there are any reverse effects. It has been suggested that we put a highly polished piece of copper rod in every test load of material, in order that we may get, at no additional cost, an indication of the effects both materials tested may have on copper. We will carry on as much of this work as our testing facilities and schedule permits.

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Hoskins Chromel "A"—Stainless, Soft and Spring Temper—Tag Wire, 1000
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However, our company is a relatively small organization and we cannot hope to carry out a comprehensive evaluation of all the materials that may be involved in compatability problems. We feel that compatability data on wire and cable materials, and this includes the textiles and metals, has been neglected by materials suppliers to the industry.

* * *

In my own experience I once had the problem presented to me of brass connectors turning green in contact with a vinyl jacket. After costly trials of each ingredient in the vinyl jacket, one of the stabilizers was pinpointed as the offender. The data sheet on that particular stabilizer indicated that it was a top performance product, and it was, but I contend that the data sheet should have read "not recommended for use in proximity with copper bearing metals". The chemist who designed that stabilizer must have known the reactions possible in its structure.

* * *

We recognize the right, indeed we reserve it for ourselves, of a manufacturer to keep the chemistry or make-up of his material as a trade secret. We do wonder if he does not have an obligation to point out with what other materials his product should not be used.

* * *

We all know that the basic ingredients in insulating materials are members of chemical groups or families. We further know that generally in the same family the reaction to another family will be similar. If users of these materials were given general compatability data at the outset, they would be saved in-service failures and much unnecessary testing and research.

Conclusion

1. Compatability of insulating materials will become an increasing problem in equipment failures in coming years.

* * *

2. A uniform and reliable

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short-time test for service compatibility is needed soon.

* * *

3. The problem of compatibility does not seem to be that of the electric cable and insulating materials industry alone, but should be shared by the suppliers to those industries.

The Cold Facts About the American Steel Industry

(*Continued from page* 1546)

ered only about two-thirds of the cost of maintaining present production facilities, to say nothing of replacing them with the latest, most modern equipment. We shovel out billions of dollars in "aid" to a large part of the world, but do nothing to help the pressing needs of industry at home. Foreign governments recognize and make realistic depreciation allowances. Our government would be well advised to develop a better understanding of and attitude toward this problem.

Instead of talking about "excess profits" that do not exist, it might be asked what the government is doing to help American firms recapture lost markets at home and abroad.

* * *

It has been suggested that the government set official ceilings on prices. Quite the reverse is needed—a continuation of an open market where prices are set by the economics of competition.

* * *

It would help a great deal if the government, in making contract awards, re-established the 25% differential in favor of the American company, provided its bids did not exceed the foreign ones by more than 25%.

* * *

There must be an honest, accurate appraisal of the steel industry in which the same yardsticks that apply to "Big Steel" are not applied to "Little Steel", whose financial situation is much the more critical.

* * *

If the government really wants to nurture the national economy, it well could begin by reducing the big squeeze on "Little Steel."

Portugal Opens New Steel Mill

A large steel works at Seixal, near Lisbon, Portugal, the first heavy industry in the country, was started up on August 24th by President Tomaz.

* * *

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* * *

Rolling mills are expected to produce 150,000 tons of steel for concrete reinforcing, wire, tubing and other products and 50,000 tons of sheet and rails.

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* * *

The Torrington looper can form all standard types of loops on springs with an unusually wide diameter range of from 1/8" to 3/4" and body lengths from

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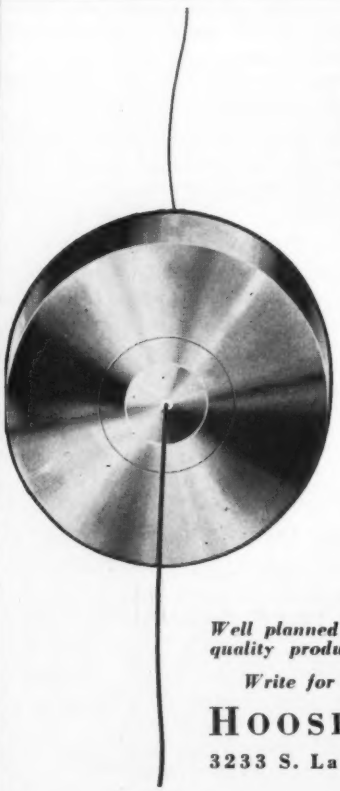
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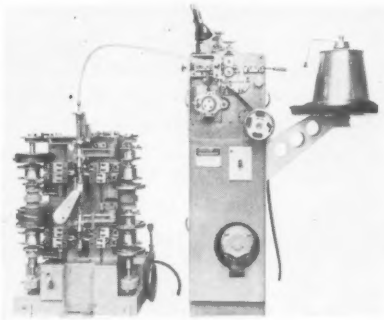

smaller the diameter of wire, the greater the skill in set-up required). Since the difficulty of manually handling small springs on kick presses prevents an output of much over 400 springs/hr, the labor saving offered by the Torrington looper's operation at speeds up to 4200 springs/hr on very small springs is particularly advantageous.

* * *

Further information on the Torrington modular looper may be obtained by writing Machine Division, The Torrington Manufacturing Co., Torrington, Conn.

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* * *

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Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

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Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Amchem Products Inc., Ambler, Pa.

CLEANERS—Metal
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Circle Chemical Co., Chicago, Ill.
Magnuson Products Corp., Brooklyn, N. Y.
Miller R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.
Wheelabrator Corporation, Mishawaka, Ind.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH—Wire, All Metals—
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Amchem Products Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
U. S. Borax, New York, N. Y.

COLOR CONCENTRATES—For Wire Coatings
Blane Corporation, The, Canton, Mass.

COMPOUNDS—Brazing
Steele Company, M. G., Rome, N. Y.

COMPOUNDS—Coppering
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill
Miller, R. H., Co., Inc., Homer, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Alabama Wire Die Co., Fayette, Ala.
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion, for Wire
Amchem Products Inc., Ambler, Pa.
Blane Corporation, The, Canton, Mass.
Circle Chemical Co., Chicago, Ill.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

COMPOUNDS—For Improving Drawing & Extrusion
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Metal Finishing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Phosphate Coating
Amchem Products, Inc., Ambler, Pa.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Chemical Products Corporation, E. Providence, R. I.
Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Removing
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corp., Brooklyn, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

COMPOUNDS—Vinyl
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
Swift & Company, Chicago, Ill.
U. S. Borax, New York, N. Y.

CONDUCTORS—Flexible, Electrical
Laribee Wire Inc., Camden, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

CONTROL PANELS—
Walco Electric Co., Providence, R. I.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

CUTTING TOOLS—Wire
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.
Robinson, M. W. Co., Rockville, Conn.

DIAMONDS—Industrial
Alabama Wire Die Co., Fayette, Ala.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIAMOND POWDERS—
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND POWDER RECLAIMING—
Alabama Wire Die Co., Fayette, Ala.
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIAMOND TOOLS—
Wayne Wire Die Co., Linden, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

DIES—Diamond
Alabama Wire Die Co., Fayette, Ala.
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J. Inc., New York, N. Y.
Brenon, Inc., Edison, N. J.
Ft. Wayne Wire Die Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES DIAMOND—Controlled Drawing Angle
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

DIES DIAMOND—Reversible
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Alabama Wire Die Co., Fayette, Ala.
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Edison, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Swaging
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Variable Speed
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

DRUMS—Wire Packaging
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio

DUST COLLECTORS—Wet or Dry
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

ENGINEERS—Consulting
Bawden, William D., Wilton, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Anchem Products, Inc., Ambler, Pa.
Chemical Products Corporation, E. Providence, R. I.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Annealing, Vacuum
American Laubscher Corporation, New York, N. Y.

FURNACES—Galvanizing Equipment
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
American Laubscher Corporation, New York, N. Y.
Carl Mayer Corp., The, Cleveland, Ohio
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson Lee Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
American Laubscher Corporation, New York, N. Y.
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

FURNACES—Strand Annealing
American Laubscher Corporation, New York, N. Y.
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GUIDES—For Wire
Alabama Wire Die Co., Fayette, Ala.
Heany Industrial Ceramic Corp., New Haven, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool & Machine Co., Auburn, Mass.

HOISTS—Electric
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Walco Electric Co., Providence, R. I.

INHIBITORS—Pickling
Amchem Products, Inc., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Chemical Products Corporation, E. Providence, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Blane Corporation, The, Canton, Mass.
Dow Corning Corporation, Midland, Mich.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

LACQUERNG SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Climax Molybdenum Co., Div., American Metal Climax, Inc., New York, N. Y.
Swift & Co., Chicago, Ill.

MACHINE CONTROLS—Electronic
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Armoring (Cable, Wire, Hose)
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Assembling
Pan American Supply Co., Long Island City, N. Y.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan

MACHINERY—Blast Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

MACHINERY—Bolt, Rivet, Screw, etc.
Gavlick Machinery Corporation, Bridgeport, Conn.
National Machinery Co., Tiffin, Ohio
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Fall, R. I.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Brazers for Wire
Steele Company, M. G., Rome, N. Y.

MACHINERY—Bunching
Cook Mfg. Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Cable, Electric
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corp., New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Pan American Supply Co., Long Island City, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Chain Making
Pan American Supply Co., Long Island City, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Closing Cable
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Coulter & MacKenzie Machine Co., Bridgeport, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Cold Forging
National Machinery Co., Tiffin, Ohio
Unitech Products, Inc., Hartford, Conn.

MACHINERY—Cold Heading
National Machinery Co., Tiffin, Ohio
REM Sales Incorporated, Subsidiary of The Robert E. Morris Co., West Hartford, Conn.
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Cook Mfg. Co., The, Paterson, N. J.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N.Y.
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden
National Mach'y Exch., (Used), New York
Showa Machine Works, Ltd., Osaka, Japan
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.
Whitacre Corporation, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Mettler Machine Tool, Inc., New Haven, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Cutters, Hydraulic for Rod & Bar
Manco Mfg. Co., Bradley, Ill.
Porter, H. K., Inc., Somerville, Mass.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Corporation, Alhambra, California
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Descaling Rod, Dry
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fisher Associates, New York, N. Y.
Herborn Machinery Corporation, Hackensack, N. J.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Diameter Control
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.

MACHINERY—Die Making
Alabama Wire Die Co., Fayette, Ala.
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Sjogren Tool & Machine Co., Auburn, Mass.
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
American Laubscher Corp., New York, N. Y.

Gavlick Machinery Corporation, Bridgeport, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Eccentricity Control
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.

MACHINERY—Edging (See MACHINERY—Tandem Rolling and Edging Mills)

MACHINERY—Enameling
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio
Torrington Manufacturing Co., Torrington, Conn.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Forming Wire
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Pan American Supply Co., Long Island City, N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Miyazaki Iron Works, Ltd., Osaka, Japan
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.

MACHINERY—Impregnation Control Paper Cables
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.

MACHINERY—Insulating Wire
American Insulating Mach'y. Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
Cook Mfg. Co., The, Paterson, N. J.

MACHINERY—Lock Washer
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Looms, Wire Weaving
EVG., Machinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

MACHINERY—Measuring and Control—Coating
Davis-Standard, Div. of Franklin Research and Development Corp., Mystic, Conn.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Co., Tiffin, Ohio
National Mach'y Exch. (Used), N.Y., N.Y.
Pan American Supply Co., Long Island City, N. Y.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Pin
REM Sales Incorporated, Subsidiary of The Robert E. Morris Company, West Hartford, Conn.

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch., (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.

MACHINERY—Preheaters, Wire
Federal Manufacturing Company, Wallingford, Conn.
Muirhead Instruments, Inc. (Addison Electric Co., Ltd.) New York, N Y.
Waico Electric Co., Providence, R. I.

MACHINERY—Printing on Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Acrometal Products, Inc., Minneapolis, Minn.
Bartell Machine Tool Corp., Rome, N. Y.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
National Mach'y Exch. (Used), New York, N. Y.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Spark Testing
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.

MACHINERY—Special
American Machinery Co., Inc., Mentor, Ohio
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Spring Making
Gavlick Machinery Corporation, Bridgeport, Conn.
National Mach'y Exch., (Used), New York, N. Y.
Pan American Supply Co., Long Island City, N. Y.
Torrington Manufacturing Co., Torrington, Conn.
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Straightening & Cutting
American Laubscher Corp., New York, N. Y.
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Pan American Supply Co., Long Island City, N. Y.
Patterson Machine Co., The Geo. C., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Haskell-Dawes Machine Co., Phila., Pa.
Johnson Machinery Co., Elizabeth, N. J.
Krupp, Fried, Maschinen-und Stahlbau, Rheinhausen, Germany
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.

MACHINERY—Tandem Rolling & Edging Mills
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., New York, N. Y.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Take-Up and Pay-Out
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
General Engineering (Radcliffe) Co., Ltd., Manchester, England
Johnson Machinery Co., Elizabeth, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Prutton Corporation, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.

Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Manufacturing Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Tube Mill, Cold Drawing
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N.J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
Gavlick Machinery Corporation, Bridgeport, Conn.
Johnson Machinery Co., Elizabeth, N. J.
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Variable Speed Drives
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Welded Wire Mesh
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Schlatter, Ltd., H.A., Zollikon, Zurich

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Emory Company, Robert J., Newark, N. J.
Federal Manufacturing Company, Wallingford, Conn.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York, N. Y.
Cook Manufacturing Co., The, Paterson, N.J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Gavlick Machinery Corporation, Bridgeport, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., New York, N. Y.
Miyazaki Iron Works, Ltd., Osaka, Japan
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Pan American Supply Co., Long Island City, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Showa Machine Works Ltd., Osaka, Japan
Societa Generale Delle Macchine Mill, Milan, Italy
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Straus-Artys Corp., Great Neck, N. Y.
Superior Tool & Machinery Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Tanisaka Iron Works Ltd., Amagaski, Hyogo, Japan
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wartenweiler, Emilio, Milano, Italy—SAMP
Waterbury-Farrel Fdy. & Mach. Co., Inc., Div. of Textron, Inc., Waterbury, Conn.
Watkins & Sons, Inc. R. S., Sandy Hook, Conn.
Whitacre Corporation, Alhambra, California
Wire Machinery Inc., Chicago, Ill.

MACHINERY—Wire Rope
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp, New York, N. Y.
Larmuth (1947) Ltd., Cheshire, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

MOLYBDENUM-DISULFIDE—Lubricants
Climax Molybdenum Company, a division of American Metal Climax, Inc., New York, N. Y.

MOTORS—Electric
Allis Co., Louis, Milwaukee, Wisc.
Walco Electric Co., Providence, R. I.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Mach. Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Co., Winsted, Conn.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAPER—Coil Wrapping
Ludlow Corporation, Needham Heights, Mass.

PAPER—Insulating
Ludlow Corporation, Needham Heights, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Chemical Products Corporation, E. Providence, R. I.
Dow Corning Corporation, Midland, Mich.
Kenrich Petrochemicals, Inc., Maspeth, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.

PREHEATERS—Wire
Federal Manufacturing Company, Wallingford, Conn.
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.
Walco Electric Co., Providence, R. I.

PRINTING WHEELS—for Electric Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—for Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool & Mach. Co., Auburn, Mass.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Acrometal Products, Inc., Minneapolis, Minn.
Mettler Machine Tool, Inc., New Haven, Conn.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio

REELS & SPOOLS—Custom Made
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS—Plywood
Antrim Reel, Inc., Haverhill, Mass.
Carris Reels, Inc., Rutland, Vermont
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vermont
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Nelson Co., The, Baltimore, Md.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
Antrim Reel, Inc., Haverhill, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Carris Reels, Inc., Rutland, Vermont
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Nelson Co., The, Baltimore, Md.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
Western Wire Corporation, Boston, Mass.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Eaton Mfg. Co., Massillon, Ohio
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Northwestern Steel & Wire Co., Sterling, Illinois
Sumitomo Metal Industries, Ltd., Osaka, Japan
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Yawata Iron & Steel Co., Ltd., Tokyo, Japan

ROPE—Wire
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons, Div., Colorado Fuel & Iron Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Removing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SCRAP WIRE—Bare or Insulated, Bought
Electro Metals Separation Co. Div. of M. J. Stavola & Co., Inc., Danbury, Conn.

SILICONE RUBBER—For Wire Insulation
Dow Corning Corporation, Midland, Mich.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—For Retail Sale of Wire
Antrim Reel, Inc., Haverhill, Mass.
Carlton Manufacturing Co., Pawtucket, R. I.
Clark Manufacturing Co., J. L., Rockford, Illinois

SPOOLS—Paper
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.

SPOOLS—Plastic
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Merrimac Spool & Reel Co., Inc., Haverhill, Mass.
Plastic Mold & Eng. Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS—
Jarke Manufacturing Co., Chicago, Illinois

STRAND—Galvanized Steel
Southwire Co., Carrollton, Ga.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.

Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)

TENSION METERS—for Wire
Boulin Instrument Corp., Pelham, N. Y.
Tensitron, Inc., Harvard, Mass.

TESTERS—INSULATION
(See Testing Equipment—for Dielectric Faults)

TESTING EQUIPMENT—Dielectric Faults in Insulation
Davis Electric Co., Wallingford, Conn.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Muirhead Instruments Inc. (Addison Electric Co., Ltd.) New York, N. Y.

TESTING EQUIPMENT—Physical
Scott Testers, Inc., Providence, R. I.
Steele Company, M. G., Rome, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL-Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

TRANSMISSIONS—Variable Speed (See Adjustable Speed Drives)

TRAVERSE & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

VARNISHES & LACQUERS—for Electric Wire
Chemical Products Corporation, E. Providence, R. I.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Herborn Machinery Corporation, Hackensack, N. J.
Micro Products Co., Chicago, Ill.
Schlatter, Ltd., H.A., Zollikon, Zurich

WHEELS—for Printing on Electric Wire
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—ACSR
Southwire Co., Carrollton, Ga.

WIRE—Aluminum
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.

WIRE—Ball
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Ball & Roller Bearing
Eaton Mfg. Co., Massillon, Ohio

WIRE-Braiding, Flat
Steel Heddle Mfg. Co., Philadelphia, Pa.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Brush
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Building, Electric
Southwire Co., Carrollton, Ga.

WIRE—Bunched and Stranded
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Western Wire Corporation, Boston, Mass.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Copper
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.
Malin & Co., The, Cleveland, Ohio
Southwire Co., Carrollton, Ga.
Steel Heddle Mfg. Co., Philadelphia, Pa.

WIRE—Coppered Stainless Steel
Western Wire Corporation, Boston, Mass.

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.

WIRE—Flat
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Montgomery Co., The, Windsor Locks, Conn.
Steel Heddle Mfg. Co., Philadelphia, Pa.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Galvanized
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Northwestern Steel & Wire Co., Sterling, Illinois
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Detroit Steel Corporation, Detroit, Mich.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Insulated
Southwire Co., Carrollton, Ga.

WIRE—Manufacturers
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Berger Div., Canton, Ohio
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers Limited, Warrington, England
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Metalizing
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Malin & Co., The, Cleveland, Ohio
Suzuki Metal Industry Co., Ltd., Tokyo, Japan

WIRE—Needle
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Plated
Steel Heddle Mfg. Co., Philadelphia, Pa.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Suzuki Metal Industry Co., Ltd., Tokyo, Japan
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—for Prestressed Concrete
Rylands Brothers, Limited, Warrington, England
Suzuki Metal Industry Co., Ltd., Tokyo, Japan

WIRE—Pin
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.

WIRE—Special Shapes
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Eaton Mfg. Co., Massillon, Ohio
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Suzuki Metal Industry Co., Ltd., Tokyo, Japan
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stainless Steel
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Nippon Stainless Steel Wire Mfg. Co., Ltd., Osaka, Japan.
Pittsburgh Steel Co., Pittsburgh, Pa.
Suzuki Metal Industry Co., Ltd., Tokyo, Japan
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Western Wire Corporation, Boston, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Maryland Fine & Specialty Wire Co., Inc., Cockeysville, Md.
Northwestern Steel & Wire Co., Sterling, Illinois
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Rylands Brothers, Limited, Warrington, England
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Stranded & Bunched
Laribee Wire, Inc., Camden, N. Y.

WIRE—Tinned
Camden Wire Co., Camden, N. Y.
Laribee Wire, Inc., Camden, N. Y.
Steel Heddle Mfg. Co., Philadelphia, Pa.

WIRE—Tire Bead
Suzuki Metal Industry Co., Ltd., Tokyo, Japan

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WRAPPING PAPER—Creped
(See PAPER-Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Chadwick Yarn Company, Pawtucket, R. I.
Synthetic Thread Co., Bethlehem, Pa.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 16, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE AND MASTICATING MACHINERY MANUFACTURERS

WATSON

PLANETARY STRANDERS. Three types, many sizes, for all duties, geared or ring backturn, main rotor shaft or roller support. "Shaftless" no-loose-part cradles.

RIGID FRAME STRANDERS "RH". Horizontal, overhung spindle designs. Ball bearing main rotor shaft support, no support rollers.

CABLERS. Planetary and High Speed types.

TUBULAR STRANDERS "TH". High speed type in all sizes.

TUBULAR STRANDERS "VL". New, extra high speed, extra low lead angle design. Quick loading "Shaftless" no-loose-part cradles.

VERTICAL BUNCHERS. Minimum floor space, double twist types. 250, 500 and 1,000 pound capacity.

HEAVY DUTY TAKEUPS. "Shaftless" in many designs and sizes. Mechanical, hydraulic and motorized lift.

CLOSERS. Planetary, Rigid Frame and High Speed types for Wire Rope and Electric Cables.

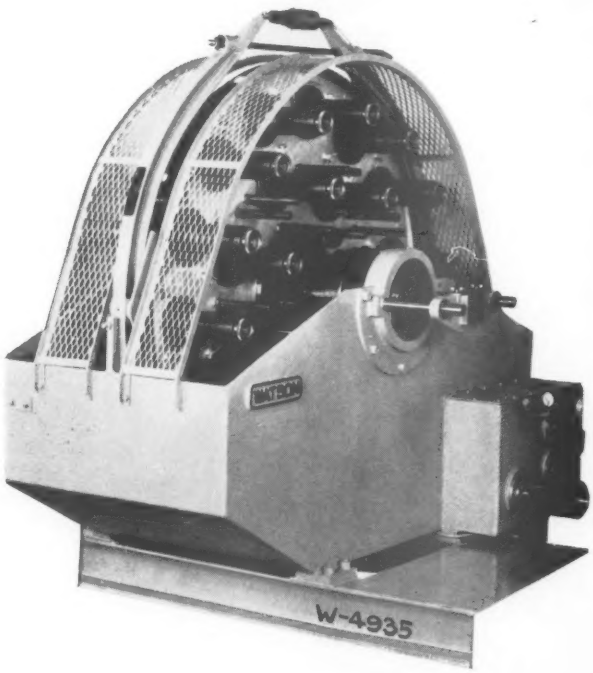
ARMORING MACHINES. Complete with Planetary Wire or Metal Tape Heads.

JUTERS. 36 or 48 Cop and to 6" cable passage.

SERVING HEADS. Concentric and Eccentric, many designs for threads, asbestos, etc.

TAPING HEADS. Many types and sizes. For metallic and non-metallic tapes. Eccentric, Single and Double Concentric. Uniform tensions.

COMPOUND AND SATURATING TANKS. Many types.



CONTINUOUS TAKEUPS. Double reel designs, constant tension, wide speed range.

TAKEUP TRANSMISSIONS. Heavy duty type "D". combines two-speed transmission, manual slack-takeup drive, and multiple-disc-in-oil friction mechanism in one complete unit.

AUTOMATIC TRAVERSES. Many sizes and designs cover range from fine wire to large cable and wire rope. Wide lay range. Fully automatic and disconnectible for manual operation. Widely used as replacements for inadequate mechanism on older takeups.

CHALK, MICA AND OTHER POWDER APPLIERS. "Wet and Dry" types available.

CAPSTAN SECTIONS. Single tapered wheels to 10 foot dia. with standard shoe fleeter or ball bearing ring fleeters. Double grooved types to 96" dia.

TRACTOR CAPSTANS. Available in two types with sizes to suit many applications.

LET-OFFS. Manual, mechanical, hydraulic and electric motor lift types and "Shaftless" designs.

GANG SPOOLERS. Table and Floor types in many sizes and designs.

REWINDERS AND COILERS. All motorized, for warehouse and shipping use.

CAPSTAN TAKEUPS. Single and in multiples.

VULCANIZERS. Cavity and Plate "Patch" units. Mechanically or pneumatically operated.

MOLDED SHEAVES. Low cost, light weight Bakelite sheaves 11" O. Dia x 8" Groove Dia., in many colors.

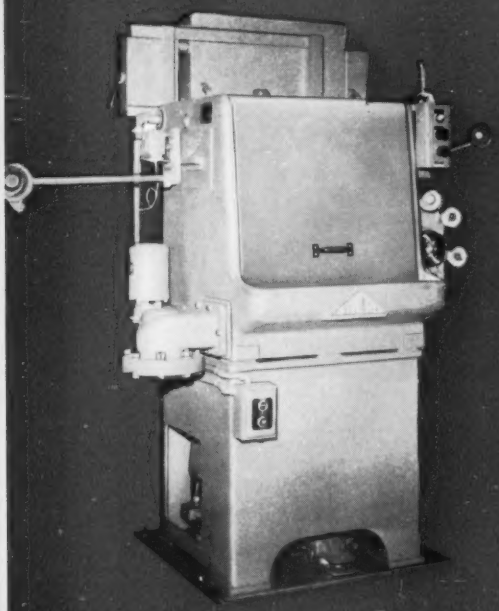
TESTING MACHINES. Impact, Torsion, Bend and Endurance types.

MEASURING MACHINES. For linear measurement. Offered in a variety of types and sizes.

REEL CRUTCHES. For turning very large and heavy reels. Widely used wherever reel handling is a problem. Available from stock.

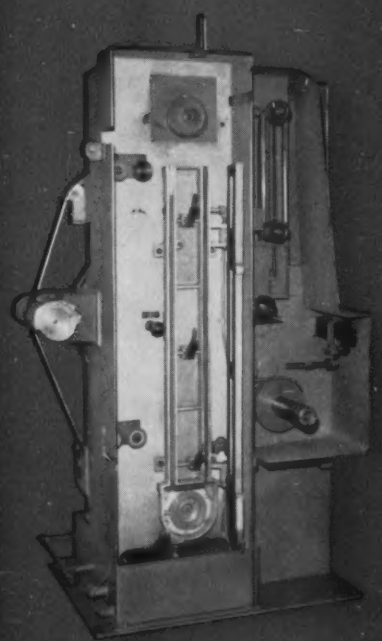
CABLE PLANT AND WIRE ROPE MILL EQUIPMENT. Many other designs, too numerous for listing, for general and special purpose work are available on which inquiries are invited.

Our Design Aims: SAFETY — SIMPLICITY — PRODUCTIVITY



wire drawing annealing spooling

at highest possible • speeds from **SYNCRO**



Syncro Model BG Fine Wire Drawing Machine in combination with Model AB-3S Resistoneal* and Spooler gives you maximum production in one operation—Drawing, Annealing, Spooling. Finished wire ranges from #26 to #36 B&S gauge, while operating at maximum production speeds with up to 100 lb. capacity spool.

This is only one example of the pace setting, high quality machines in Syncro's complete line of Wire Drawing and Cable Mill machinery—the result of dynamic research and engineering.

Our engineers welcome the opportunity to assist you. For further information write to: Syncro Machine Company, Perth Amboy, New Jersey.

"Better Machinery for the Wire Industry"

*registered trademark

Stranders • Annealers • Wire Drawing Machines • Payoffs • Capstans • Heavy Duty Take-Ups

SYNCRO MACHINE COMPANY

affiliated company: Winget-Syncro Ltd., Rochester, Kent, England